

**Preparatory Committee for the 2010 Review
Conference of the Parties to the Treaty on the
Non-Proliferation of Nuclear Weapons**

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**Partnerships for peaceful nuclear cooperation: United States
support for article IV of the Treaty on the Non-Proliferation
of Nuclear Weapons**

Paper submitted by the United States of America

The United States voluntarily submits this paper for the purpose of explaining an important aspect of how we facilitate fulfilment of the objectives of article IV of the NPT.

Please note that the information contained herein is accurate as of 2005. We will endeavour to update this information at a future time.



THE UNITED STATES AND AFGHANISTAN



SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Afghanistan in support of these efforts, both bilaterally and through the IAEA.

HUMAN RESOURCE DEVELOPMENT AND NUCLEAR TECHNOLOGY SUPPORT

Nuclear techniques could play a significant role in rebuilding Afghanistan's infrastructure in areas such as human health, agriculture, water resources development, and radiation protection. In the past, Afghanistan participated in IAEA country, Interregional, and Regional West Asia TC projects in areas such as nuclear science, nuclear physics, radiotherapy, radiopharmaceuticals, isotope hydrology, and radiation protection.

In 1978, the IAEA completed a TC project in Afghanistan



Credit: Massoud Samiei/IAEA

to establish a radiotherapy unit in order to increase the number of cancer patients treated in the country. Afghanistan also took part in a Regional TC project to improve the quality control of radiopharmaceuticals for diagnostic procedures in

cardiology, neurology and oncology. This project helped the participating states develop indigenous capability for preparing the kits and ligands needed for single-photon-emission computerized tomography (SPECT) imaging procedures.

In the area of isotope hydrology and water resource management, Afghanistan took part in a Regional TC project on isotope hydrology in the Middle East. This project helped participating member states assess and develop ground-water resources, which in turn has contributed to



Credit: R. Faidutti/UN FAO

better water resource planning and management.

Afghanistan has recently expressed its desire to resume participation in IAEA TC activities. Afghanistan is particularly interested in working with the IAEA in the health sector to establish facilities to treat cancer and other serious diseases.



Through Technical Cooperation Projects, the IAEA is helping Afghanistan rebuild its infrastructure in areas such as agriculture, human health, isotope hydrology and nuclear safety. (IAEA Headquarters, Vienna, Austria. Credit: Vadim Mouchkin/IAEA)

In 2004, an IAEA TC project was approved for Afghanistan to establish, upgrade and strengthen the necessary skills and capabilities in nuclear science and applications. This project would enable Afghanistan to work closely with the IAEA in other areas to develop projects that address many of the country's immediate needs.

Exchanges and training missions between the U.S. and Afghan counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- From 1963-1979, the U.S. accepted **3 Fellows** from Afghanistan in nuclear radiochemistry, radiotherapy, and raw materials. **Of these Fellows, 2 were fully funded by the U.S.**
- In 1992, an Afghan participated an IAEA Interregional Training Course on "Planning, Organization and Implementation of Radiation Protection," hosted by the U.S.



ANL/IAEA Interregional Training Course
Planning, Organization and Implementation of
Radiation Protection at the National Level
11-29 May 1992

Credit: Argonne National Laboratory

Afghanistan is encouraged to continue to apply for IAEA fellowships and to participate in IAEA training courses held in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the U.S. has cooperated with Afghanistan on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

In 1983, an Afghan student received a Ph.D. from a U.S. university in the area of nuclear studies.

OFFICIAL VISITS

Since 1988, 5 Afghans have either visited or been assigned to U.S. Government facilities.

THE UNITED STATES AND ALGERIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



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AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



The use of nuclear techniques to obtain plant species best adapted to drought and salinity is important in combating desertification. (Credit: Lydia Baben/IAEA)

For countries in arid and semi-arid regions, desertification and the degradation of soil pose serious economic and environmental problems. The IAEA is working with the Algerian Government to combat desertification in Algeria. The use of nuclear techniques combined with other techniques can help identify and develop plant species that

are resistant to drought and salinity. The long-term goal of the project is to restore and maintain soil fertility and to prevent dry land degradation.

Agriculture Fellowships and Training in the U.S.

Since 1978, nine Algerian Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiei/IAEA

The IAEA is currently implementing two TC projects in Algeria in order to strengthen the national capacity in radiotherapy and training in medical physics. The first project aims to improve the quality of cancer treatment by increasing the number of trained personnel and equipment. The second project focuses on improving the quality of care provided by strengthening national capacity for academic and clinical training in medical physics.

Algerian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, Algerian physicians have also obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: WSSD Brochure/USAID, DOE & DOS

In Algeria, the IAEA is implementing a TC project to develop national capability in the use of isotopes for sustainable exploitation of groundwater resources. This project will combine isotope methods with conventional techniques and will lead to a better understanding of Algeria's water resources, thereby contributing to their optimal management. Algeria is also participating in two Regional Africa TC projects on the use of isotope hydrology in water resource management.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Algerian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, approximately **41 Algerians** participated in **26 training courses** hosted by the U.S.
- From 1959–2004, the U.S. accepted **six Fellows and Scientific Visitors** from Algeria. **Of these Fellows, one was fully funded by the U.S.**
- In the past 15 years, U.S. experts made **three exchange missions to Algeria** to assist in the implementation of IAEA Technical Cooperation projects.

Algerian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Isotope Hydrology** – Argonne National Laboratory
- **Nuclear Safety** – University of New Mexico
- **Food Preservation** – University of Rhode Island
- **Nuclear Physics** – University of Texas
- **Radiochemistry** – Virginia Polytechnic Institute
- **Agricultural Biochemistry** – U.S. Department of Agriculture



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Algeria have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, 34 Algerian students received Ph.D.'s from U.S. universities in the area of nuclear studies, and an additional 13 Algerians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 136 Algerians have either visited or been assigned to U.S. Government facilities, and several U.S. officials have visited Algeria.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Algeria since 1979. Such exchanges have provided technical assistance in the areas of radiation transport and safety.

Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND ARGENTINA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Argentina in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



There have been several national and regional projects in Argentina in the area of **Plant Breeding and Genetics** aimed at improving the country's food security. One of such projects currently underway is using nuclear techniques to improve the country's rice, wheat, and barley crops. This project, supported by the U.S. since 1995, is enhancing the genetic make-up of crops to increase their adaptability to drought, salinity and other environmental constraints, thus improving crop yield and enhancing economic conditions in the region.

Agriculture Fellowships and Training in the U.S.

- *Since 1959, 52 Argentine Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1990, Argentine counterparts have participated in three training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



Currently, there are eight national and regional Nuclear Medicine-related TC projects ongoing in Argentina.

One of these projects is improving the management and control of hepatitis B and C by increasing detection capability and working to prevent the spread of the disease. A similar project also underway is upgrading the country's radiotherapy capabilities to ensure that patients undergoing treatment or diagnosis receive a safe and uniform dosage.

Argentine Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972, twenty Argentine physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: WSSD Brochure/U.S.AID, DOE & DOS)

One of such projects currently underway is using nuclear techniques to evaluate the level of contamination in the **Nahuel Huapi National Park**. Previous studies of two lakes in the region showed evidence of mercury and other heavy metal contaminants, both of which adversely affect human health. This project is investigating the source of the contamination so other water resources in the area are protected from similar pollutants.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Argentine counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1976, approximately 112 Argentines participated in 68 training courses hosted by the U.S.*
- *From 1959-2002, the U.S. accepted 64 Fellows and 105 Scientific Visitors from Argentina, 32 of which were fully funded by the U.S.*
- *For the past 25 years, U.S. experts made over 88 exchange missions to Argentina to assist in the implementation of IAEA Technical Cooperation projects.*



(Source: David Kinley/IAEA)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Argentina have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1963, 22 Argentine students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 37 Argentines received Ph.D.'s in the field of physics.

SISTER LAB AGREEMENT

In October 1997, the *National Atomic Energy Commission of the Argentine Republic (CENEA)* and the *U.S. Department of Energy* entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and CENEA counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*

Current cooperation is focused on the development of Boron Neutron Capture Therapy (BNCT), a nuclear medicine technique used during cancer treatment that reduces the damage to surrounding healthy tissue.

OFFICIAL VISITS

For the past 15 years, over 550 Argentines have either visited or been assigned to U.S. Government facilities, and over 200 U.S. officials have visited Argentina.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Argentina since 1972. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND ARMENIA



SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

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HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiei/IAEA

The **Oncological Scientific Center (OSC)** in Yerevan is the only hospital in Armenia with a specialized cancer treatment department. The IAEA has been implementing two TC projects to improve the quality and effectiveness of radiotherapy services at the OSC through the provision of modern equipment and the improvement of quality assurance and quality control and safety. Both projects will help ensure safe, affordable treatment for cancer patients in Armenia.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed

safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container (Credit: IAEA)

The IAEA is currently implementing two TC projects in Armenia with a focus on improving safety at the **Armenian Nuclear Power Plant (ANPP)**. The first project aims to improve the monitoring of environmental contamination as well as radiation protection of plant personnel. The second project focuses on ageing management and corrosion-erosion analysis. Both projects will help ensure safe and reliable long-term operation of the ANPP.

With the help of a U.S. Extrabudgetary Contribution, the IAEA is also implementing a TC project to strengthen the **Armenian Nuclear Regulatory Authority (ANRA)**. This will contribute to increased safety at nuclear installations in Armenia.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Armenian counterparts work to build the capacity of local leaders by providing hands-on experience in

handling more sophisticated science and technological tools.

- Since 1980, **30 Armenians** participated in **20 training courses hosted by the U.S.**
- From 1998-2004, the U.S. accepted **10 Fellows** and **3 Scientific Visitors** from Armenia.
- Since 1994, **43 U.S. experts** provided services in Armenia in medical physics, safety of reactors and nuclear materials, safety standards and radiation protection.

Armenian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts at a variety of U.S. institutions in the following technical areas:

- **Safety of Reactors and Nuclear Material** – Argonne National Laboratory
- **Radiation Protection** – Oak Ridge National Laboratory
- **Safety Standards, Regulations and Procedures** – Brookhaven National Laboratory
- **Quality Assurance** – Argonne National Laboratory
- **Power Reactors** – Sonalyst Incorporation
- **Treatment and Disposal of Radioactive Waste** – Gilbert/Commonwealth Inc.



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Armenia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1996, 8 Armenian students received Ph.D.'s from U.S. universities in the field of physics.

OFFICIAL VISITS

During the past 15 years, over 21 Armenians have either visited or been assigned to U.S. Government facilities.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Exchanges of computer codes and related technical assistance have occurred between the U.S. and Armenia since 1999. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND BANGLADESH THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



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AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



In Bangladesh, rice provides 90 percent of the country's food requirements, yet each year farmers are experiencing decreases in crop output, while the country's population continues to increase. In order to meet this growing demand, farmers are using their land for intensive cultivation of rice, thus causing nutrient mining from the soil, increasing pest population, and deteriorating groundwater quality due to excessive use of water, chemical fertilizers, and pesticides. *To deal with this problem, the IAEA initiated a TC project that is using nuclear techniques to improve fertilizer, water, and pesticide management practices, thus increasing crop production and leading to environmentally friendly and economically sustainable agriculture development in the country.*

Agriculture Fellowships in the U.S.

- *Since 1978, 56 Bangladeshi Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

The U.S. is currently supporting a nuclear medicine-related Technical Cooperation project in Bangladesh that is improving the quality and safety of radiation treatment provided to cancer patients. This project is establishing and standardizing imaging and therapeutic procedures in nuclear oncology at the **Institute of Nuclear Medicine in Dhaka**. The project will result in improved treatment of liver cancer, thyroid cancer, rheumatoid arthritis and coronary artery disease.

Nuclear Medicine Training in the U.S.

In addition to support for the above projects, since 1979, Bangladeshi counterparts have participated in over 50 fellowships and scientific visits in the areas of nuclear medicine, radiotherapy, medical physics, and radiopharmacy.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: WSSD Brochure/U.S.AID, DOE & DOS)

Arsenic contamination of groundwater has affected 59 of the 64 districts in Bangladesh where arsenic levels have been found to be above internationally accepted standards for safe drinking water. It is reported that about 21 million people are currently exposed to arsenic contamination and approximately 70 million people may be at risk. *One TC project, currently working to improve this situation, is using nuclear techniques to analyze groundwater resources and identify the source of the contamination, leading to an increase in the availability of clean water. The result of this project will be better health and improved quality of life for millions of people in Bangladesh.*

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Bangladeshi counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *From 1978-2002, the U.S. accepted 188 Fellows and 26 Scientific Visitors from Bangladesh, 84 of which were fully funded by the U.S.*

Bangladeshi Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Medicine* – U.S. National Institute of Health
- *Research Reactors* – Oak Ridge National Laboratory
- *Radiation Protection* – U.S. Nuclear Regulatory Commission
- *Sterile Insect Technique* – University of Florida
- *Nuclear Security* – Argonne National Laboratory



IAEA/ANL Interregional Training Course on:
Emerging Nuclear Safety Issues for Decision Making

(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Bangladesh have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1974, 16 Bangladeshi students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 17 Bangladeshis received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 165 Bangladeshis have either visited or been assigned to U.S. Government facilities, and numerous U.S. officials have visited Bangladesh.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Bangladesh since 1984. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND BELARUS THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



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AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



In support of the Belarusian Research Institute for Soil Science and Agrochemistry, a TC project was recently completed in the area of **Food and Environmental Protection**. A pilot plant for the production of edible oil from locally produced rapeseed oil grown on agricultural land contaminated by the Chernobyl accident was established.

This pilot plant now has the capacity to produce 5 tons of edible oil per day. A modern three-stage filtration system, supplied by the IAEA, allows the production of food-grade oil practically free from radionuclides. The new facilities are foreseen to produce more than 4,000 tons of rapeseed oil with the level of radionuclide contamination 40 times lower than the national permissible level. This rapeseed project is demonstrating to farmers that the land can be recovered for safe and productive uses. Over the coming years, the Government should increase investment in this area and should seek to stimulate cooperative efforts leading to job opportunities and profitable markets for farmers.

Belarusian Nuclear Physicians Certified in the U.S.

Since 2000, one Belarusian physician obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Argonne National Laboratory)

For the new approved medicine-related Technical Cooperation projects in 2003, the system of quality assurance (QA) and quality control (QC) in the **Clinical Oncology Dispensary** of the Gomel region for x-ray diagnostic procedures will be established. This will lead to the reduction of costs and doses received by patients undergoing diagnostic radiology examinations while improving the quality of medical images. The other project is to upgrade national QA/QC system in the radiotherapy hospitals in Belarus. This project will result in improving level of safety, efficiency, and effectiveness of radiotherapy treatment of cancer patients and hospital workers.

Nuclear Safety Fellowships in the U.S.

In 2003, a fellow from Belarus has trained in the U.S. in the area of radiation protection at Savannah River Ecology Laboratory in South Carolina.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Vadim Mouchkin/IAEA)

In order to minimize the impact of the Chernobyl accident on human health and to create favorable conditions for the sustainable development of the affected territories, the IAEA is assisting the country by providing expert services to develop a set of detailed procedures for carrying out decontamination actions in many contaminated settlements at a relatively low cost. In addition, the IAEA provided radiation and waste safety training for graduates and staff at the **International Sakharov Institute of Radioecology (ISIR)**.

The U.S. is also supporting several regional Europe TC projects in such areas as strengthening of regional preparedness and response of nuclear emergencies, physical protection and security of nuclear materials, and safety review of research reactor facilities.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Belarusian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1993, approximately 20 Belarusians participated in 15 training courses hosted by the U.S.*
- *From 1998-2003, the U.S. accepted 3 Fellows from Belarus.*

- *Since 1995, 17 U.S. experts provided services in Belarus in safety in nuclear energy, applications of isotopes and radiation in agriculture, and general atomic energy development.*

Belarusian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Safety in Nuclear Energy** – Sandia National Laboratory
- **Research Reactors** – Argonne National Laboratory
- **Radiation Protection** – Savannah River Ecology Lab.



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Belarus have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1993, several Belarusian students received a Ph.D. from U.S. universities in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 30 Belarusians have either visited or been assigned to U.S. Government facilities, and more than 100 U.S. officials have visited Belarus.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Belarus since 1996. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety. Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND BOLIVIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



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ISOTOPE HYDROLOGY



Credit: WSSD Brochure/U.S.AID, DOE & DOS

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources.

Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.

Approximately 2 million people live in the **La Paz River Basin** in Bolivia. With rapid population growth and increased industrial and agricultural activity, the risk of river and groundwater pollution in this region is increasing. To address this problem, the IAEA has been implementing a TC project in Bolivia to use nuclear analytical technique to establish a water resources management system in the region. By monitoring the organic and microbiological composition of the water system, the Bolivian Government will be able to develop a water resources management and pollution control system to ensure the quality and quantity of the water supply for the people in this region.

AGRICULTURE



Credit: IAEA

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of

improving agricultural production. Such techniques have been used for:

- **Eradicating and controlling insects**
- **Increasing the yield, quality and disease resistance of crops**
- **Improving the quality of food and protection from spoilage and losses**
- **Promoting animal health and productivity**

Farmers in the **Cochabamba Region** rely on forest products and tropical fruits for cash crops. However, excessive use of pesticides hampers trade and endangers the environment. The IAEA has been implementing a TC project in Bolivia to develop pesticide residue monitoring capabilities. The goal of this project is to establish sustainable pesticide monitoring capability in Bolivia as well as a pesticide risk management strategy in order to reduce the use of pesticides.

Agriculture Fellowships and Training in the U.S.

Since 1971, three Bolivians have trained in the U.S. in the areas of entomology and plant breeding and genetics.

HUMAN HEALTH



Credit: Massoud Samet/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment

of diseases such as cancer and malaria.

Chagas disease is a parasitic disease spread by Triatomine bugs found primarily in Central and South America. If untreated, the disease can cause severe cardiac problems and even death. With the help of a U.S. extrabudgetary contribution, the Agency completed a TC project in Bolivia on using nuclear medicine for the early detection, diagnosis and treatment of Chagas disease. The Agency assisted with the establishment of five nuclear medicine centers in Bolivia and has helped broaden the research and treatment of the disease in Bolivia.

The Agency has also been implementing a TC project in Bolivia to improve uterine and cervix cancer control by upgrading and strengthening radiotherapy capabilities at the Instituto Oncologico del Oriente Boliviano in Santa Cruz, Hospital Obrero, Complejo Hospitalario Viedma in Cochabamba and the Cancer Institute in Sucre.

Bolivian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, a Bolivian physician obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Bolivian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1980, **18 Bolivians** participated in **10 training courses** hosted by the U.S.
- From 1971-2004, the U.S. accepted **12 Fellows** and **11 Scientific Visitors** from Bolivia. **Of these Fellows, 7 were fully funded by the U.S.**
- Since 1978, **16 U.S. experts** provided services in Bolivia in nuclear medicine, isotope hydrology, plant breeding and genetics and radiation protection.

Bolivian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts at a variety of U.S. institutions in the following technical areas:

- **Economic Aspects of Nuclear Energy** – Argonne National Laboratory
- **Sterile Insect Technique** – University of Florida
- **Nuclear Engineering and Technology** – Argonne National Laboratory
- **Radioanalytical Techniques** – New Mexico State University



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Bolivia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1964, three Bolivian students received Ph.D.'s from U.S. universities in the field of physics.

OFFICIAL VISITS

During the past 15 years, over 24 Bolivians have either visited or been assigned to U.S. Government facilities.

THE UNITED STATES AND BOSNIA AND HERZEGOVINA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Bosnia and Herzegovina in support of these efforts, both bilaterally and through the IAEA.



NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed



Members of an IAEA safety mission in Bosnia-Herzegovina, March 2003 (Credit: T. Cabianca/IAEA)

safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.

Bosnia and Herzegovina has been participating in several country and regional TC projects in nuclear safety. These projects have focused on

national regulatory control, regaining control over "orphan sources," radiation and waste safety, transportation safety, emergency preparedness, and upgrading the radiation protection infrastructure.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection



Credit: Massoud Samiei/IAEA

equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The IAEA has been implementing a TC project in Bosnia and Herzegovina to establish

a radiotherapy center in **Banja Luka**. Currently, cancer patients have to travel either to the radiotherapy center in Sarajevo or abroad for treatment. The Agency is

assisting in designing the center, selecting the appropriate equipment and ensuring that it meets safety standards, initiating quality assurance and quality control procedures, and training personnel. This second center will increase Bosnia and Herzegovina's cancer treatment capacity and will help lower treatment costs.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: Argonne National Laboratory

Bosnia and Herzegovina has been participating in a Regional Europe TC project on the uses of nuclear

techniques to improve the control of Brucellosis in sheep and goats in the region. Brucellosis is an infectious disease that affects livestock, causing decreased milk production, weight loss and infertility. The disease spreads quickly and is transmissible to humans. Better control of the disease among sheep and goats will reduce the risk of it spreading to other animals and humans and will also lead to increased trade in milk products.

HUMAN RESOURCE DEVELOPMENT

The U.S. supports exchanges and training missions with several countries to build the capacity of local leaders by providing hands-on experience in handling more sophisticated scientific and technological tools. Every year, fellows, scientific visitors and training course participants from around the world receive training at American universities and institutes in several fields including entomology, plant breeding and genetics, animal diseases, groundwater hydrology, nutritional and health-related environmental studies, nuclear medicine and radiotherapy.

Bosnia and Herzegovina is encouraged to apply for IAEA fellowships and to participate in IAEA training courses held in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Bosnia and Herzegovina have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

In 1995 a Bosnian and Herzegovinian student received a Ph.D. from a U.S. university in the area of nuclear studies.

OFFICIAL VISITS

Since 1993, 3 Bosnian and Herzegovinians have either visited or been assigned to U.S. Government facilities.

THE UNITED STATES AND BOTSWANA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Botswana in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Laboratory for the rearing of sterilized tsetse flies. (Credit: David Kinley/IAEA)

In Botswana, the IAEA has been implementing a TC project to assist the country with its efforts to eliminate the tsetse fly from the **Okavango Delta**. In 2001 and 2002, the government of Botswana carried out a highly successful tsetse intervention campaign in this region through the use of the sequential aerosol technique (SAT). The current TC project will introduce a Sterile Insect Technique (SIT) "mop-up" campaign to render

the area completely tsetse-free. In order to ensure that the tsetse-free zone is sustainable, the project will be extended to neighboring regions in Namibia, Angola and Zambia. The creation and maintenance of a tsetse-free zone will make the development of agriculture and tourism in this region possible, which, in turn, will contribute to economic and sustainable development.

Agriculture Training in the U.S.

In 1999, a Botswana participant in an Interregional Training Course at the University of Florida on the Use of the Sterile Insect and Related Techniques for the Area-Wide Management of Insect Pests.

HUMAN RESOURCE DEVELOPMENT

The U.S. supports exchanges and training missions with several countries to build the capacity of local leaders by providing hands-on experience in handling more sophisticated scientific and technological tools. Every year, fellows, scientific visitors and training course participants from around the world receive training at American universities and institutes in several fields including entomology, plant breeding and genetics, animal diseases, groundwater hydrology, nutritional and health-related environmental studies, nuclear medicine and radiotherapy.

Botswana is encouraged to apply for IAEA fellowships and to participate in IAEA training courses held in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

THE UNITED STATES AND BRAZIL

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Brazil in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE



Larval trays for mass production of fruit flies (Credit: Lindquist/IAEA)

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity

Brazil is a major producer of fruit for both export and domestic consumption. Insects such as the medfly, fruit fly and codling moth are a threat to production and export. The Sterile Insect Technique (SIT) is one method used to control/eradicate these harmful pests. In order to produce a sufficient amount of sterile male medflies and codling moths for use in the SIT, the IAEA has begun

implementing a TC project in Brazil to establish a medfly and codling moth rearing facility. This facility will also be used to rear fruit fly parasitoids, the natural enemies of fruit flies, for release.

Agriculture Fellowships and Training in the U.S.

Since 1959, 58 Brazilian Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

Since 1986, Brazilian counterparts have participated in six training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good



Credit: Massoud Samiei/IAEA

health. Radio-isotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

Health-related IAEA Technical Cooperation projects in Brazil have focused on the provision of radiation sources and equipment, personnel training in medical physics and safety, and the establishment and proper maintenance of radiotherapy programs for cancer treatment.

Brazilian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, 11 Brazilian physicians have also obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

INDUSTRY

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and



minimize the adverse impacts of industrial emissions on the environment.

In Brazil, a Technical Cooperation project in the area of

Water Resources and Development used nuclear techniques to assess the pollution resistance of the Paiva Castro Reservoir, which serves as the major water supply for 12 million people in the Sao Paulo area. This project assessed how much safe drinking water would be available in the event of accidental contamination of an adjacent water source.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Brazilian counterparts work to build the capacity of local leaders, by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, approximately **182 Brazilians** have participated in **107 training courses hosted by the U.S.**
- From 1959-2004, the U.S. has accepted **206 Fellows** and **96 Scientific Visitors** from Brazil. Of these Fellows, **42 were fully funded by the U.S.**

Brazilian Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- Massachusetts Institute of Technology
- Stanford University
- Argonne National Laboratory
- Brookhaven National Laboratory
- Texas A&M University
- U.S. Nuclear Regulatory Commission
- U.S. Geological Survey

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Brazil have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958, 82 Brazilians received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 27 Brazilian students received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 25 years, over 850 Brazilians have either visited or been assigned to U.S. Government facilities, and over 420 U.S. officials have made visits to Brazil.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Brazil since 1968. Such exchanges have provided technical assistance in the areas of radiation transport and safety. Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND BULGARIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Bulgaria in support of these efforts, both bilaterally and through the IAEA.



NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Kozloduy nuclear power plant. The IAEA is implementing a TC project in Bulgaria to ensure the safe decommissioning of Units 1 and 2 of the Kozloduy NPP. (Credit: Jean Paul Bemer / IAEA)

Bulgaria has been participating in several country and Regional Europe TC projects in such areas as decommissioning, occupational radiation protection, national regulatory control and upgrading the radiation and waste safety infrastructure.

With the help of a U.S. Extrabudgetary Contribution, the IAEA is implementing a TC project to strengthen the capabilities of the **Bulgarian Nuclear Regulatory Agency (BNRA)** in the areas of licensing, development of nuclear safety standards and regulations and quality assurance of inspection activities. This will contribute to an increase in the safety of nuclear installations in Bulgaria.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- **Eradicating and controlling insects**
- **Increasing the yield, quality and disease resistance of crops**
- **Improving the quality of food and protection from spoilage and losses**
- **Promoting animal health and productivity**



Credit: Argonne National Laboratory

Bulgaria has been participating in two Regional Europe TC projects in the field of agriculture. The first uses nuclear techniques together with fertigation to increase crop production and water-use efficiency.

The second project uses nuclear techniques to improve the control of Brucellosis in sheep and goats in the region. Brucellosis is an infectious diseases that affects livestock causing decreased milk production, weight loss and infertility. The disease spreads quickly and is transmissible to humans. Better control of the disease among sheep and goats will reduce the risk of it

spreading to other animals and humans and will also lead to increased trade in milk products.

Agriculture Fellowships and Training in the U.S.

Since 1981, 33 Bulgarian Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

HUMAN HEALTH



Credit: Massoud Samiei/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment

of diseases such as cancer and malaria.

Bulgaria is currently participating in a Regional Europe TC project in the field of human health with the goal of improving health services for patients by training physicians in modern nuclear medicine practices. Bulgaria is also taking part in a Regional Europe TC project to establish quality assurance and quality control in radiation oncology.

Bulgarian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1973, six Bulgarian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Bulgarian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1981, **111 Bulgarians** participated in **72 training courses** hosted by the U.S.
- From 1987-2004, the U.S. accepted **106 Fellows** and **23 Scientific Visitors** from Bulgaria. Of these **Fellows, 51** were fully funded by the U.S.
- Since 1981, **88 U.S. experts** provided services in Bulgaria in radiotherapy, animal diseases, nuclear safety, nuclear energy, economic aspects of atomic energy and nuclear physics.

Bulgarian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts at a variety of U.S. institutions in the following technical areas:

- **Safety in Nuclear Energy** – Sandia National Laboratory
- **Treatment and Disposal of Radioactive Waste** – Gilbert/Commonwealth Inc.
- **Nuclear Safety** – Argonne National Laboratory
- **Sterile Insect Technique** – University of Florida
- **Radiation Protection** – Oak Ridge Institute for Science and Education
- **Environmental Protection** – University of Washington



(Credit: Argonne National Laboratory)

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Bulgaria have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1964, nine Bulgarian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 31 Bulgarians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

During the past 15 years, over 200 Bulgarians have either visited or been assigned to U.S. Government facilities.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Exchanges of computer codes and related technical assistance have occurred between the U.S. and Bulgaria since 1982. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND CAMEROON

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Cameroon in support of these efforts, both bilaterally and through the IAEA.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: Argonne National Laboratory

In Cameroon, the IAEA has been implementing a TC project to develop isotopic techniques to study the condition of the **Duala Sedimentary Basin**. Previously, the groundwater in this region was not monitored for changes in the water table, recharge yields or pollution. A better understanding of the conditions of the Basin will help ensure the availability of safe potable water for the population in the region.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing

conventional methods of improving agricultural production. Such techniques have been used for:

- **Eradicating and controlling insects**
- **Increasing the yield, quality and disease resistance of crops**
- **Improving the quality of food and protection from spoilage and losses**
- **Promoting animal health and productivity**



Credit: Vadim Mouchkin/IAEA

Livestock and livestock products play an important role in the economic development of Cameroon. The IAEA has been implementing a TC project in Cameroon to help the **National Veterinary Laboratory (LANAVET)** expand the use of molecular biology techniques to the diagnosis and surveillance of epidemic diseases such as contagious bovine pleuropneumonia (CBPP) and African Swine Fever (ASF). Control of CBPP and ASF will contribute to increased production of livestock and livestock products.

The Organization of African Unity's Interafrican Bureau for Animal Resources (OAU/IBAR) and the Pan-African Programme for Control of Epizootics (PACE) both work to ensure livestock health and to

control and prevent the spread of livestock diseases in Africa. Cameroon has been participating in a Regional Africa TC project that provides assistance to the OAU/IBAR/PACE Program for the Control and Eradication of Major Diseases Affecting Livestock. The U.S. has provided over \$250,000 in extrabudgetary funds to support this program.

Agriculture Fellowships and Training in the U.S.

In 1994, a Cameroonian participated in an Interregional Training Course on Use of Radiation and Isotopes in Insect Control and Entomology at the University of Florida.

HUMAN HEALTH



Credit: Petr Pavlicek/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the

diagnosis and treatment of diseases such as cancer and malaria.

Cameroon is participating in a TC project to enhance the radiotherapy capabilities at the **General Hospitals in Yaoundé and Douala**. Cameroon has also been taking part in a Regional Africa TC project to establish regional training capability in medical physics and to develop and sustain quality assurance programs in radiotherapy. Both projects will increase the number of patients that can be safely treated.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Cameroonian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1980, **six Cameroonians** participated in **five training courses** hosted by the U.S.
- From 1973-2004, the U.S. accepted **one Fellow** and **two Scientific Visitors** from Cameroon. **The Fellow was fully funded by the U.S.**

- Since 1993, **two U.S. experts** provided services in Cameroon in analytical chemistry and nuclear instrumentation, electronics and reactor control.

Cameroonian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts at U.S. institutions in the following technical areas:

- **Groundwater Hydrology** – Argonne National Laboratory
- **Sterile Insect Technique** – University of Florida
- **Analytical Chemistry** – University of California, Berkley



Credit: Argonne National Laboratory

Cameroon is encouraged to continue to apply for IAEA fellowships and to participate in IAEA training courses in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Cameroon have occurred on a direct, bilateral basis:

OFFICIAL VISITS

During the past 15 years, over 18 Cameroonians have either visited or been assigned to U.S. Government facilities.

THE UNITED STATES AND CHILE

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Chile in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



One of such projects, supported by the U.S., used nuclear techniques in the area of **Plant Breeding and Genetics** to improve food production and security in Chile and the surrounding region. This project utilized mutation-breeding techniques to enhance the genetic make-up of rice and other cereals, making them less susceptible to disease, insect pest infestation, and adverse soil and climate conditions.

Agriculture Fellowships and Training in the U.S.

- *Since 1961, 26 Chilean fellows and scientific visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1986, Chilean counterparts have participated in entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Juanita Perez Vargas - IAEA)

The IAEA recently began a regional technical cooperation project in Chile that is working to improve radiation oncology services to cervical cancer patients. This project is focused on infrastructure development, training, and provision of new equipment for diagnostic and treatment centers. These improvements will assure that the local population will have access to cancer detection and advanced treatment technologies.

Chilean Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1974, five Chilean physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

A regional Latin American project currently underway in Chile is using nuclear techniques to develop and implement sustainable groundwater management systems. Through this project, local counterparts are instituting policies and procedures that ensure an integrated and sustainable water resources management plan. The project aims to assure that the regional population of approximately 10 million people will have continued access to water resources.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Chilean counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1977, approximately 67 Chileans participated in 47 training courses hosted by the U.S.*
- *Since 1961, the U.S. accepted 99 fellows and 37 scientific visitors from Chile, 23 of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Chilean fellows, scientific visitors, and course participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Safety* – Argonne National Laboratory
- *Food Preservation* – Texas A&M University
- *Nuclear Medicine* – Brookhaven National Lab
- *Nutrition & Health* – U.S. Department of Agriculture



(Source: Argonne National Lab)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Chile have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1954, 11 Chilean students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 24 Chileans received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 206 Chileans have either visited or been assigned to U.S. Government facilities, and 138 U.S. officials have visited Chile.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Chile since 1981. Such exchanges have provided technical assistance in the areas of radiation transport and safety.

THE UNITED STATES AND CHINA

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with China in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in improving agriculture production. These techniques can be used to increase crop output as well as to eradicate harmful insect pests.



Under the tenure of former IAEA Deputy Director General (DDG-TC) Jihui Qian of China, the U.S. worked closely with the IAEA on several agriculture-related TC projects. These projects included some of the major TC efforts initiated by DDG Qian, including the eradication of the tsetse fly from Zanzibar in Tanzania. The U.S. also collaborated with DDG Qian in the development of strategies to improve the overall effectiveness of the TC program.

In China, IAEA agriculture-related TC projects focused on improving the country's rice industry. Rice is a staple food for more than half of the country's population but is increasingly susceptible to pests and environmental constraints. In 1995, the IAEA began a TC project using nuclear plant breeding techniques to improve rice crop yield and resistance to disease. This project allowed farmers to grow new varieties of rice, improving quality and quantity, thus generating higher income.

Agriculture Fellowships and Training in the U.S.

- *Since 1984, 22 Chinese Fellows and 19 Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1986, Chinese counterparts have participated in five entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek - IAEA)

The IAEA is currently working with the **Chinese Academy of Medical Sciences** and the **Guiyang Medical College** to establish a regional screening network for neonatal

congenital hypothyroidism (CHT). CHT is a metabolic disorder that is treatable if diagnosed early in life, and is particularly common among Asian babies. A neonatal screening program will contribute to early detection, diagnosis, and treatment of these children, which will improve the quality of life as well as prevent treatable mental retardation.

Chinese Nuclear Physicians Certified in the United States

In addition to support for the above projects, since 1972, 58 Chinese physicians obtained certifications to practice nuclear medicine from the **American Board of Nuclear Medicine**.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: *World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS*)

Supply of clean water for domestic consumption is a top priority of the Chinese Government. The **Guanzhong Basin** is situated in Central China and 90 percent of the water needs of the local population are met by this supply of groundwater. With the fast growing economic and industrial sectors, water shortage and pollution problems are becoming increasingly severe. As a result, the IAEA initiated a TC project that is working with local counterparts to evaluate the long-term availability of water from this source and to explore the possibility of using other groundwater resources. This project will aid in the improvement of the country's overall water management policies.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Chinese counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1984, approximately 135 Chinese participated in 73 training courses hosted by the U.S.*
- *Since 1984, the U.S. accepted 159 Fellows and 115 Scientific Visitors from China.*

TRAINING IN THE U.S.

Chinese Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Nuclear Safety** – Argonne National Laboratory
- **Food Preservation** – Texas A&M University
- **Nuclear Medicine** – Johns Hopkins University
- **Agricultural Biochemistry** – U. S. Department of Agriculture



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and China have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1984, 300 Chinese students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 499 Chinese received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 7,815 Chinese have either visited or been assigned to U.S. Government facilities, and over 1,000 U.S. officials have visited China.

EXPERT MISSIONS

In the past 25 years, U.S. experts made over 124 exchange missions to China to assist in the implementation of technical cooperation projects.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and China since 1975. These exchanges provide assistance in a variety of technical areas, including radiation transport and safety.

THE UNITED STATES AND COLOMBIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Colombia in support of these efforts, both bilaterally and through the IAEA.



AGRICULTURE



Credit: IAEA

have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity

The IAEA recently completed a TC project in Colombia using nuclear techniques to evaluate pesticide residues in fruits, flowers and vegetables. Excessive pesticide use has negatively impacts health, the environmental and the economy. The goal of the project was to establish a reliable pesticide monitoring program to assist the government in controlling the type and amount of pesticides used.

Agriculture Fellowships and Training in the U.S.

Since 1963, 14 Colombian Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Water vendors on the streets of Santa Marta, Colombia (Credit: Juanita Perez Vargas/IAEA)

Colombia has been participating in a Regional Latin America TC project on sustainable management of groundwater resources. This project focuses on using isotope techniques together with conventional techniques to better understand the availability and quality of water resources as well as pollution risks. This information will enable governments in the region to effectively manage existing groundwater sources.

HUMAN HEALTH



Credit: Massoud Samiei/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The IAEA has been implementing three TC projects in Colombia in the area of human health. Two of the projects seek to improve cancer treatment in the country by enhancing the radiotherapy and teletherapy services at the **National Institute of Oncology**. The third project focuses on improving health services while at the same time reducing costs by introducing nuclear medicine techniques in the fields on oncology, cardiology, immunology, pediatrics and chronic and degenerative diseases.

Colombian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972 10 Colombian Physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

INDUSTRIAL APPLICATIONS AND NUCLEAR TECHNIQUES IN DEMINING

According to the 2000 UNICEF Anti-personnel Mine Report, approximately 100,000 landmines are scattered throughout Colombia. The Colombian government is committed to detecting and clearing all anti-personnel mines. To this end, they have been participating in an IAEA TC project on determining the optimal nuclear techniques to be used for demining. Through fellowships, expert advice and the provision of equipment, the IAEA will assist Colombia with developing a prototype for detecting anti-personnel mines.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Colombian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1980, **21 Colombians** have participated in **14 training courses** hosted by the U.S.
- From 1963-2004, the U.S. has accepted **66 Fellows** and **10 Scientific Visitors** from Colombia. **Of these Fellows, 44 were fully funded by the U.S.**
- Since 1978, **37 U.S. experts** provided services in Colombia in nuclear medicine, food preservation, reactor technology, groundwater hydrology, economic aspects of nuclear energy, and radiotherapy.

Colombian Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Nuclear Engineering and Technology** – Argonne National Laboratory
- **Radiometry and Dosimetry** – University of Texas at San Antonio
- **Radiation Protection** – Argonne National Laboratory
- **Economic Aspects of Atomic Energy** – Argonne National Laboratory



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Colombia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1964, 5 Colombian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 14 Colombians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 19 years, over 106 Colombians have either visited or been assigned to U.S. Government facilities, and over 27 U.S. officials have visited Colombia.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Colombia since 1996. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND COSTA RICA

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Costa Rica in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



The U.S. is currently supporting an IAEA Technical Cooperation project in Costa Rica that is working with the **Center for Cellular and Molecular Biological Research (CIBCM)** at the **University of Costa Rica**

to detect viruses in plant species. An epidemic of viruses in the region has had damaging effects on the economy and the environment, particularly harming some of the country's most important crops. The ability to diagnose the presence of plant diseases early and accurately is important for planning early countermeasures and reducing costs. The project will not only improve producer's income but also seeks to establish a commercial service that will allow the local counterparts to collect income from providing viral analysis services to consumers throughout the region.

Agriculture Fellowships and Training in the U.S.

- *Since 1972, 13 Costa Rican Fellows and five Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1981, Costa Rican counterparts have participated in four entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Juanita Perez Vargas - IAEA)

In 2003, the IAEA began a project with the **Nuclear Medicine Service of the Hospital San Juan de Dios** to upgrade the hospital's equipment and qualify its staff in radiotherapy techniques. The project will result in improved health care services offered at the national level, increased survival rates of thyroid cancer patients, and an overall improvement of the quality of life of cancer patients.

Costa Rican Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1972, three Costa Rican physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

The IAEA recently completed a TC project in Costa Rica that used isotope hydrology techniques to identify the main sources of groundwater pollution in the aquifers of the **Central Valley**. The increased knowledge of pollution sources in rivers and aquifers gained from this project is enabling local counterparts to take corrective and preventive actions, thus improving the long-term accessibility of safe drinking water.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Costa Rican counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1980, approximately 10 Costa Ricans participated in 8 training courses hosted by the U.S.*
- *Since 1972, the U.S. accepted 26 Fellows and 5 Scientific Visitors from Costa Rica, 14 of which were fully funded by the U.S.*
- *In the past 15 years, U.S. experts made over 24 exchange missions to Costa Rica to assist in the implementation of IAEA Technical Cooperation projects.*

TRAINING IN THE U.S.

Costa Rican Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Physics* – Florida State University
- *Plant Breeding* – U.S. Department of Agriculture
- *Nuclear Medicine* – U.S. National Institutes of Health

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Costa Rica have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1974, five Costa Rican students received Ph.D.'s from U.S. universities in the areas of nuclear studies and physics.

SISTER LAB AGREEMENT

In 1998, the *Costa Rican Atomic Energy Commission* and the *U.S. Department of Energy's Argonne National Laboratory* entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and Costa Rican counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*



(Source: David Kinley -IAEA)

OFFICIAL VISITS

For the past 15 years, over 43 Costa Ricans have either visited or been assigned to U.S. Government facilities, and 66 U.S. officials have visited Costa Rica.

THE UNITED STATES AND CROATIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Croatia in support of these efforts, both bilaterally and through the IAEA.



ISOTOPE HYDROLOGY



Rainfall is an important source of freshwater recharge (Credit: Rodolfo Quevenco/IAEA)

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management

programs by providing information on sources, movement, and quantity of water in a variety of environments.

The **Karstic Area** of Croatia contains several important groundwater storage reservoirs that provide water for the entire country. The IAEA is implementing a TC project in Croatia that uses isotopic techniques to determine the recharge mechanisms of these reservoirs. A better understanding of the recharge rate and the impact of pollution will help the government develop a water management policy to protect the water supply.

HUMAN HEALTH



Credit: Massoud Samiet/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

Croatia is continuing to expand its use of modern nuclear techniques and equipment in the health sector. The IAEA is currently carrying out a TC project to strengthen the expertise of nuclear medicine specialists and physicists in positron emission tomography (PET). Croatia is also participating in an IAEA TC project to establish a **University Hospital for Tumors (UHT)** in **Zagreb** in order to perform stereostatic radiotherapy (SRT.) This procedure uses multiple narrow photon beams to treat small brain tumors. Establishing such a hospital will allow cancer patients previously treated abroad to be treated more affordably in Croatia.

Croatian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, in 1990, a Croatian physicians obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

NUCLEAR SAFETY



Inspectors investigate the safety of a fuel container (Credit: IAEA)

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste

management, and transportation safety.

Croatia has been participating in several country and Regional Europe TC projects in such areas as

radioactive waste management, waste safety, transport safety, control of orphan sources, radiation protection and preparedness and response for nuclear emergencies.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Croatian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1982, **33 Croatians** participated in **27 training courses** hosted by the U.S.
- From 1994-2004, the U.S. accepted **12 Fellows** and **6 Scientific Visitors** from Croatia. Of these Fellowships, **5 were fully funded by the U.S.**
- Since 1993, **29 U.S. experts** provided services in Croatia in safety of reactors and nuclear material, economic aspects of atomic energy, safety evaluation, analytical nuclear physics and waste safety.

Croatian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts at a variety of U.S. institutions in the following technical areas:

- **Safety in Nuclear Energy** – Sandia National Laboratory
- **Radiation Protection** – Environmental Protection Agency
- **Nutritional and Health Related Environmental Studies** – Argonne National Laboratory
- **Safety Standards, Regulations and Procedures** – Argonne National Laboratory
- **Waste Treatment/Disposal** – Brookhaven National Laboratory
- **Safety of Reactors and Nuclear Materials** – Environmental Systems Research Institute
- **Environmental Protection** – State Department of Environmental Conservation, Albany, New York



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Croatia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1993, four Croatian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 14 Croatians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

During the past 10 years, over 47 Croatians have either visited or been assigned to U.S. Government facilities.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Exchanges of computer codes and related technical assistance have occurred between the U.S. and Croatia since 2001. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND THE CZECH REPUBLIC THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with the Czech Republic in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

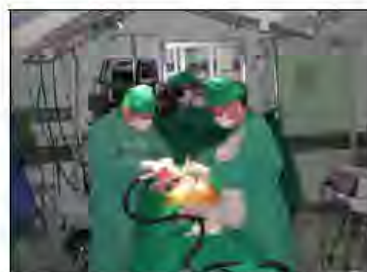
- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



Since 1982, Czech counterparts have traveled to the U.S. to participate in several training courses on the use of sterile insect and related techniques for the area-wide management of insect pests. Czech participants have also attended training courses held at the U.S. Department of Agriculture on various aspects of agricultural biochemistry.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

The IAEA recently completed a TC project that worked with the Czech Republic's **State Office of Nuclear Safety** to improve Quality Assurance (QA) measures in

radiotherapy. The newly developed QA and audit tools seek to improve the quality of radiology examinations and the accuracy of radiotherapy treatment. Improved accuracy of the dose delivered to patients will contribute to an increased cure rate and better quality of life.

Nuclear Medicine in the Czech Republic

In addition to the above project, the IAEA is currently carrying out a regional TC project in the Czech Republic that is aimed at upgrading nuclear medicine procedures in hospitals throughout the region so they comply with internationally accepted standards. This project will increase the capacity of local counterparts to use radiotherapy techniques for the management of childhood diseases, cancer, coronary artery disease and degenerative disorders.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: Vadim Mouchkin/IAEA)

The IAEA recently completed a TC project in the Czech Republic that used nuclear techniques to monitor the impact of the **Temelin Nuclear Power Plant (NPP)** on neighboring water supplies. This project was funded by the United States and carried out by the U.S. Environmental Protection Agency (EPA) and the **Radioecology Department of the T.G. Masaryk Water Research Institute, Prague**. As a result of this project, the Masaryk Water Research Institute received the training and equipment necessary to monitor the impact of the NPP on the local environment and to ensure the safety of the local water supply.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Czech counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1977, approximately 185 Czechs participated in 94 training courses hosted by the U.S.*
- *From 1993-2002, the U.S. accepted 20 fellows and scientific visitors from the Czech Republic, 13 of which were fully funded by the U.S.*
- *For the past 10 years, U.S. experts made over 12 exchange missions to the Czech Republic to assist in the implementation of IAEA Technical Cooperation projects.*

Czech fellows, scientific visitors, and course participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Radiation Protection** – Oak Ridge National Lab
- **Entomology** – University of Florida
- **Safety Evaluation** – Argonne National Laboratory
- **Reactor & Material Safety** – U.S. Department of Energy



(Source: David Kinley/IAEA)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and the Czech Republic have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 10 years, over 90 Czechs have either visited or been assigned to U.S. Government facilities, and over 229 U.S. officials have visited the Czech Republic.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and the Czech Republic since 1981. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND THE DOMINICAN REPUBLIC

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with the Dominican Republic in support of these efforts, both bilaterally and through the IAEA.



AGRICULTURE



Credit: IAEA

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques

have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity

The Dominican Republic has been participating in two Interregional TC projects on using the sterile insect technique (SIT) to control insect pests. Both projects strive to increase public awareness of the benefits of SIT as an environmentally-friendly means for controlling insect pests.

Agriculture Fellowships and Training in the U.S.

Since 1976, three Dominican Fellows and Course Participants have trained in the U.S. in the area of entomology.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samet/IAEA

The Dominican Republic has been focusing on improving human health through nuclear applications. To achieve this, the Dominican Republic is participating in seven Regional Latin America TC projects in the field of human health. These

projects encompass a variety of areas such as quality assurance in clinical dosimetry for radiation therapy, strengthening the Master of medical physics degree, medical physics, quality assurance and quality control in mammography studies, quality assurance in radiotherapy, development of a regional telemedicine network, radiation treatment of uterine cervix cancer and strengthening the performance of professionals in the medical physics field.

Dominican Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972 four Dominican Physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

NUTRITION

Good nutrition is important for ensuring good health and is a contributing factor to social and economic development. Yet, many people, particularly in developing countries, suffer from malnutrition. Isotope techniques are a valuable tool in the global fight against hunger. They provide important information on micronutrient deficiencies. This information, in turn, can help determine the nature of nutrition problems, monitor the effectiveness of current nutrition programs and help guide the food industry in processing foods with optimal nutritional value.

Many children in the Dominican Republic suffer from deficiencies in iron, iodine and vitamin A. The **Department of Nutrition of the Secretariat of State for Public Health and Social Assistance (SEPAS)** has begun a program to provide schoolchildren with foods fortified in iron, iodine and vitamin A. The IAEA is assisting with these efforts through a TC project that uses nuclear techniques to evaluate the impact of these fortified foods. This information will help the government ensure the efficiency and effectiveness of its fortification program.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Dominican counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1984, **9 Dominicans** have participated in **7 training courses** hosted by the U.S.
- From 1976-2004, the U.S. has accepted **7 Fellows** from the Dominican Republic. **One of these Fellows was fully funded by the U.S.**
- Since 1982, **6 U.S. experts** provided services in the Dominican Republic in medical physics, radiation protection and analytical nuclear physics.

Dominican Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Entomology** – Louisiana State University
- **Analytical Nuclear Physics** – National Institute of Health and Argonne National Laboratory
- **Analytical Chemistry** – Rensselaer Polytechnic Institute



ANL/IAEA Training Course: Management and Control of Occupational Exposure to Ionizing Radiation, 29 March-16 April 1993 (Credit: Argonne National Laboratory)

The Dominican Republic is encouraged to continue to apply for IAEA fellowships and to participate in IAEA training courses in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and the Dominican Republic have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

In 1983, a Dominican student received a Ph.D. from a U.S. university in the field of physics.

OFFICIAL VISITS

For the past 18 years, over 23 Dominicans have either visited or been assigned to U.S. Government facilities, and over 10 U.S. officials have visited the Dominican Republic.

THE UNITED STATES AND ECUADOR THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Ecuador in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Promoting animal health and productivity*



In Ecuador, banana and shrimp exports account for the country's main sources of income. To keep banana production high, the country relies on large amounts of pesticides. However, the extensive use of pesticides for banana production contaminates water sources, which negatively impacts the country's shrimp production. This is especially a problem in **Guayas River Catchment**, which is the source of more than 60 percent of the country's agricultural output. *As a result, the IAEA is working with local counterparts to conduct pesticide risk assessments using nuclear and related techniques. This project will allow the country to identify the best management practices for sustainable agricultural production, which will allow for high banana output while also protecting the shrimp industry.*

Agriculture Fellowships and Training in the U.S.

- *Since 1960, 14 Ecuadorian Fellows and four Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Juanita Perez Vargas - IAEA)

In 2001, the IAEA began a technical cooperation project in Ecuador that is reactivating an old radiotherapy treatment center at the **Vicente Corral Moscoso National and Teaching Hospital**. There has been a sharp increase in the number of new cancer patients in the country's southern region and there are currently not enough radiotherapy services available to

the low-income population. As a result of this project, it is expected that more than 300 patients per year will have access to acceptable radiation therapy.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

One of such projects currently underway is using nuclear techniques to identify the sources of water seepage and contamination at the **Poza Honda** and **La Esperanza** dams. The dam and the reservoir of La Esperanza have severe contamination problems due to excessive nutrient content in the water that fills the reservoir. Conventional methods have not been successful in identifying the actual origin and entrance pathway of the nutrients into the reservoir. The application of nuclear techniques to identify the source will help to restore the water quality, thus ensuring that the local population will have access to adequate water supplies for consumption and industry.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Ecuadorian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1980, approximately 16 Ecuadorians participated in 12 training courses hosted by the U.S.*
- *Since 1959, the U.S. accepted 35 Fellows and 20 Scientific Visitors from Ecuador, 22 of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Ecuadorian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Nuclear Safety** – Argonne National Laboratory
- **Radiotherapy & Dosimetry** – University of Texas
- **Agricultural Biochemistry** – U.S. Department of Agriculture



(Source: David Kinley -IAEA)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Ecuador have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1974, three Ecuadorian students received Ph.D.'s from U.S. universities in the areas of physics.

OFFICIAL VISITS

For the past 15 years, over 24 Ecuadorians have either visited or been assigned to U.S. Government facilities, and 16 U.S. officials have visited Ecuador.

EXPERT MISSIONS

In the past 15 years, U.S. experts made over 20 exchange missions to Ecuador to assist in the implementation of technical cooperation projects.

THE UNITED STATES AND EGYPT

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Egypt in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: Vadim Mouchkin/IAEA

Egypt has been participating in a U.S. supported Regional Africa TC project to establish national capacity to diagnose and monitor major livestock diseases in the region, such as rinderpest, contagious bovine pleuropneumonia, African swine fever and foot and mouth disease. Control of these diseases will help ensure the development of sustainable rural agriculture.

There have also been several country and regional projects in Egypt that have addressed control and eradication of the Mediterranean fruit fly using the Sterile Insect Technique (SIT). The U.S. has supported SIT efforts in Egypt since 1986.

Agriculture Fellowships and Training in the U.S.

Since 1959, 48 Egyptian Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiei/IAEA

Egypt has been participating in four regional Africa TC projects on the application of nuclear medicine techniques. These projects focus on improving the safety and effectiveness of radiotherapy practice and introducing new clinical techniques; managing common cancers in Africa; using nuclear medicine techniques to improve the overall healthcare in Africa; and establishing regional capacity in medical physics.

Egyptian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972, 25 Egyptian physicians have obtained medical training certification from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



The IAEA has been implementing a TC project in Egypt to assess the groundwater resources of the **Farafra and Bahariya depressions in the Nubian Sandstone Aquifer**. The information gathered is important for the sustainable development of this area and for the development of new communities outside of the crowded Nile Valley. Egypt has also been participating in four Regional Africa TC projects on using isotope hydrological techniques to develop groundwater resources.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Egyptian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, approximately **119 Egyptians** have participated in **65 training courses** hosted by the U.S.
- From 1959-2004, the U.S. has accepted **264 Fellows** and **38 Scientific Visitors** from Egypt. Of these Fellows, **169 were fully funded by the U.S.**

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Egypt have occurred on a direct, bilateral basis

EDUCATIONAL EXCHANGES

Since 1958, 69 Egyptian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 14 Egyptians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 25 years, over 250 Egyptians have either visited or been assigned to U.S. Government facilities, and over 162 U.S. officials have made visits to Egypt.



Credit: Argonne National Laboratory

SISTER LAB AGREEMENT

In January 1994, the **Egyptian Atomic Energy Authority (EAEA)** and the **Los Alamos National Laboratory (LANL)** signed an arrangement for the exchange of technical information and for cooperation in the field of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and EAEA counterparts, facilitating various collaborative projects including:

- **Exchange of scientific and technical information**
- **Short-term visits by expert teams or individuals**
- **Training of scientific and technical personnel through fellowships, seminars or courses**

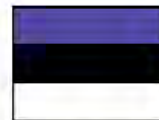
Current cooperation is focused on effective management of low-level radioactive waste disposal and management and analysis of environmental monitoring data.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Egypt since 1982. Such exchanges have provided technical assistance in the areas of radiation transport and safety. Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND ESTONIA

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Estonia in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Argonne National Laboratory)

The IAEA is currently assisting Estonia in developing and implementing a national quality assurance (QA) program in which equipment and treatment planning system in radiotherapy will be upgraded. The work will be coordinated among **North Estonian Regional Hospital in Tallinn, the Tartu University Clinic in Tartu, and the Radiation Protection Center in Tallinn.** The project will result in improving safety and quality of radiotherapy treatment for cancer patients. In addition to the national project, Estonia is also participating in two regional Europe TC projects in the areas of nuclear medicine and QA/QC in radiation oncology. The results from the projects will benefit the country's healthcare system.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Petr Pavlicek/IAEA)

The U.S. is supporting regional Europe TC projects in which Estonia is participating. The projects are in the areas of strengthening of regional preparedness and response of nuclear emergencies, and physical protection and security of nuclear materials. The U.S. also supported completed regional Europe TC projects in the areas of safety assessment capabilities of nuclear power plants (NPPs) and emergency preparedness. The results of the project have increased the ability of participating organizations and NPPs to assess their levels of operational safety and safety culture in comparison with international best practices, leading to safer NPP operation and effectiveness in emergency preparedness and response organizations and plans.

As one of the 52 participating Member States in a project on upgrading radiation protection infrastructure supported partly by the U.S., Estonia has declared attainment of all five milestones. At its request, Estonia will be reviewed by peer missions to confirm its full compliance with the project's objective.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Estonian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1997, 4 Estonians participated in a training course at Oak Ridge Institute for Science and Education in the field of Radiation Protection.*



(Source: Argonne National Laboratory)



(Source: Turker Kurtas/IAEA)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Estonia have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 15 years, approximately 30 Estonians have either visited or been assigned to U.S. Government facilities, and more than 10 U.S. officials have visited Estonia.

THE UNITED STATES AND ETHIOPIA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Ethiopia in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



(Laboratory for the rearing of sterilized tsetse flies. Source: David Kinley/IAEA)

Since 1997, the U.S. has contributed over \$1.1 million to assist Ethiopia in its efforts to eradicate the harmful tsetse fly from country's southern rift valley. The tsetse fly is a carrier of the disease trypanosomiasis, commonly known as sleeping sickness. This disease, a leading cause of loss of human life in Africa, also attacks livestock, killing as many as 3 million of such animals each year, and resulting in economic losses of more than \$4 billion annually. ***The eradication of tsetse flies will not only improve the quality of human life, but will also make more land available for crop and livestock production, thereby contributing to food security and sustainable growth in the rural economy.***

Agriculture Fellowships and Training in the U.S.

- *Since 1969, 17 Ethiopian Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1996, Ethiopian counterparts have participated in three training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Vadim Mouchkin/IAEA)

One of such projects currently underway is working to upgrade radiotherapy capabilities at the **Tikur-Anbessa Specialized Hospital in Addis Ababa**. This project will increase the number of patients the hospital is able to treat, while also upgrading the quality of radiotherapy treatment provided to patients.

Nuclear Medicine Training in the U.S.

In addition to support for the above projects, since 1981, Ethiopian counterparts have participated in numerous fellowships, scientific visits and training courses in the areas of nuclear medicine, radiotherapy, medical physics, and radiopharmacy.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



The U.S. is currently supporting a Technical Cooperation project that is using nuclear techniques to improve environmental management of the **Akaki aquifer**, near **Addis Ababa**. The population in and around Addis Ababa will benefit from an increased availability of water for domestic and agricultural use. Several million people are also expected to benefit from the supply of electricity produced by this water source, which will also reduce the demand for fuel-wood, thereby reducing negative effects on the environment.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Ethiopian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1983, approximately 16 Ethiopians participated in 12 training courses hosted by the U.S.*
- *From 1969-2002, the U.S. accepted 28 Fellows and 3 Scientific Visitors from Ethiopia, 13 of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Ethiopian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Isotope Hydrology* – Argonne National Laboratory
- *Radiation Protection* – Oak Ridge National Lab
- *Animal Diseases* – University of California
- *Plant Breeding* – U.S. Department of Agriculture



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Ethiopia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, 5 Ethiopian students received Ph.D.'s from U.S. universities in the area of nuclear studies and physics.

OFFICIAL VISITS

For the past 15 years, over 60 Ethiopians have either visited or been assigned to U.S. Government facilities, and several U.S. officials have visited Ethiopia.

THE UNITED STATES AND GHANA

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Ghana in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



(Source: Vadim Mouchkin/IAEA)

The U.S. is currently supporting a regional Africa TC project that is working with the **Organization of African Unity/Inter-African Bureau for Animal Resources (OAU/IBAR)** to develop diagnostic and surveillance programs using nuclear techniques to reduce the occurrence of major livestock diseases. Animal diseases cause high mortality rates in livestock, which threatens both quality and quantity of livestock products and discourages private investment in the sector. This program will allow local counterparts to correctly diagnose and effectively monitor and treat diseases affecting livestock. By increasing production and food security, the consumers of livestock products and the national economies will see an increase in output and enhanced trade opportunities.

Agriculture Fellowships and Training in the U.S.

- *Since 1968, 32 Ghanaian Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1986, Ghanaian counterparts have participated in two training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

Radiotherapy and nuclear medicine facilities for the diagnosis and treatment of cancer are extremely limited in Ghana. To improve services to cancer patients, the IAEA carried out a series of TC projects that have

strengthened nuclear medicine and radiotherapy capabilities at the **Korle-Bu Hospital (KBH)** in Accra. The improved facilities will provide adequate treatment to the local population who, in the past, may not have had access to such therapy.

Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1982, three Ghanaian physicians obtained certifications to practice nuclear medicine from the **American Board of Nuclear Medicine**.

INDUSTRY

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



(Source: *World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS*)

In 1999, the U.S. began supporting a technical cooperation project on investigating dam and reservoir leakages. IAEA reviews showed that many member states in the region lacked the capacity to investigate leaks of unknown origin effectively, resulting in a loss of precious water resources and also creating potential safety hazards to the surrounding population. This project is improving the capacity of local counterparts to address such leakages, thus improving the conservation and availability of water sources.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Ghanaian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1977, approximately 36 Ghanaians participated in 29 training courses hosted by the U.S.*
- *From 1973-2002, the U.S. accepted 94 Fellows and seven Scientific Visitors from Ghana, 61 of which were fully funded by the U.S.*
- *For the past 25 years, U.S. experts made over 17 exchange missions to Ghana to assist in the implementation of IAEA Technical Cooperation projects.*

TRAINING IN THE U.S.

Ghanaian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Nuclear Safety** – Argonne National Laboratory
- **Soil Science & Irrigation** – Oak Ridge National Lab
- **Nuclear Medicine** – US National Institutes of Health
- **Food Preservation** – Massachusetts Institutes of Technology



IAEA/ANL Interregional Training Course on: Emerging Nuclear Safety Issues for Decision Making

(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Ghana have occurred on a direct, bilateral basis:

SISTER LAB AGREEMENT

In October 1995, the *Ghana Atomic Energy Commission (GAEC)* and the *U.S. Department of Energy's Argonne National Laboratory (ANL)* entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and GAEC counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*

OFFICIAL VISITS

For the past 10 years, over 73 Ghanaians have either visited or been assigned to U.S. Government facilities, and several U.S. officials have visited Ghana.

THE UNITED STATES AND GREECE

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Greece in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: Argonne National Laboratory

Greece has been participating in two Regional Europe TC projects in the field of agriculture. The first uses nuclear techniques to improve the control of Brucellosis in sheep and goats in the region. Brucellosis is an infectious disease that affects livestock, causing decreased milk production, weight loss and infertility. The disease spreads quickly and is transmissible to humans. Better control of the disease among sheep and goats will reduce the risk of it spreading

to other animals and humans and will also lead to increased trade in milk products.

The second project uses nuclear techniques together with fertigation to increase crop production and efficient water use. Fertigation is a process whereby fertilizers and nutrients are distributed through irrigation systems. This process is considered the most efficient way to use fertilizers. Nuclear techniques can provide important information on irrigation management and fertilizer recovery by the crops. This will ensure proper management of soil, water, and nutrients.

Agriculture Fellowships and Training in the U.S.

Since 1961, 22 Greek Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, pomology and plant breeding and genetics.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment



Credit: IAEA

have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

Greece has been participating in a Regional Europe TC project to upgrade nuclear medicine practices to international standards. This project assesses the status and needs of nuclear medicine in participating member states. This information will help countries to formulate training strategies and work plans in order to

bring their nuclear medicine programs up to international standards.

Greek Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972 10 Greek Physicians obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container. (Credit: IAEA)

The IAEA is implementing a TC program in Greece to measure the radionuclide intake of radiation workers. Through this project, the Agency is helping the **Greek Atomic Energy Commission** upgrade its whole body counter system to improve accuracy, which will benefit the country's radiation workers.

Greece has also participated in several country and regional TC projects in nuclear safety in several areas, including dosimetry, environmental monitoring, reactor safety, emergency preparedness, waste safety, and physical protection of nuclear materials.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Greek counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- From 1976-1996, **25 Greeks** participated in **21 training courses** hosted by the U.S.
- From 1961-1999, the U.S. accepted **84 Fellows** and **14 Scientific Visitors** from Greece. **Of these Fellows, 52 were fully funded by the U.S.**
- Since 1978, **16 U.S. experts** provided services in Greece in entomology, environmental protection,

nuclear safety, nuclear physics and production of radiopharmaceuticals.

Greek Fellows, Scientific Visitors and course participants have trained alongside U.S. counterparts at the following institutions:

- **Agricultural Biochemistry** – U.S. Department of Agriculture
- **Radiation Protection** – Argonne National Laboratory
- **Safety in Nuclear Energy** – Sandia National Laboratory
- **Entomology** – University of Florida
- **Medical Applications of Radiation** – University of California Center for Health Studies



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Greece have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958, 73 Greek students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 131 Greeks received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 400 Greeks have either visited or been assigned to U.S. Government facilities, and over 350 U.S. officials have visited Greece.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Greece since 1987. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND GUATEMALA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Guatemala in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



The U.S. is currently supporting a regional Latin America TC project in Guatemala that is working to eradicate the harmful fruit fly using the sterile insect technique (SIT). Most fruits grown commercially in Guatemala are heavily damaged by fruit flies. Although Guatemala and other countries in the region have great potential for year-round production and export of tropical fruits and vegetables, agricultural exports and inter-regional trade is restricted by the existence of fruit flies. Use of SIT to reduce and eventually eradicate these insect pests will result in increased crop output and improved trade opportunities.

Agriculture Fellowships and Training in the U.S.

- *Since 1963, seven Guatemalan Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1986, Guatemalan counterparts have participated in four entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Juanita Perez Vargas -IAEA)

Once of such TC projects currently underway is working to expand the coverage of radiotherapy treatment to Guatemalan cancer patients. Presently, radiotherapy treatment in the country is only offered by the **National Cancer Institute (INCAN)** and by three private clinics. Treatment in private clinics is extremely costly and thus inaccessible to most cancer patients. This project aims to expand the services of INCAN so patients who cannot afford private clinics also have access to proper treatment.

Guatemalan Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1972, two Guatemalan physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

INDUSTRY

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

The IAEA recently completed a regional project in Guatemala that improved the country's capability to identify the origin of water leakage in dams and reservoirs using nuclear techniques. Leakage was studied in nine reservoirs used for drinking, irrigation, and electricity generation. The project identified the sources of leaking water and assisted local counterparts in applying appropriate corrective measures. The IAEA estimated that over six million US dollars were saved through the application of nuclear techniques to identify and correct the leakages. The project will also improve the country's future water resource management.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Guatemalan counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1986, approximately 14 Guatemalans participated in 12 training courses hosted by the U.S.*
- *Since 1960, the U.S. accepted 10 Fellows and Scientific Visitors from Guatemala, five of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Guatemalan Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Radiation Protection* – Argonne National Laboratory
- *Entomology* – U.S. Department of Agriculture
- *Radiation Chemistry* – U.S. Department of Energy
- *Nuclear Instrumentation* – Purdue University



(Source: David Kinley -IAEA)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Guatemala have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, two Guatemalan students received Ph.D.'s from U.S. universities in the area of physics.

OFFICIAL VISITS

For the past 15 years, over 45 Guatemalans have either visited or been assigned to U.S. Government facilities, and 32 U.S. officials have visited Guatemala.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Exchanges of computer codes and related technical assistance have occurred between the U.S. and Guatemala since 1994. Such exchanges have provided assistance in the areas of radiation transport and safety.

THE UNITED STATES AND HUNGARY

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Hungary in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*



(Source: WSSD Brochure/U.S.AID, DOE & DOS)

Like several countries in the region, Hungary is coping with a diminishing supply of water resources available for agricultural irrigation, as these valuable resources are often diverted to domestic and industrial uses, which offer better economic returns. Presently, a regional TC project is working to improve the situation for the agricultural sector by using nuclear techniques to enhance current methods of fertilization and irrigation. The result of the project will be increased water-use efficiency, improved crop production, and a reduction in the negative effects conventional methods of irrigation and fertilization place on the environment.

Agriculture Fellowships and Training in the U.S.

- *Since 1960, 12 Hungarian Fellows, Scientific Visitors and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

One of such projects currently underway is upgrading nuclear medicine procedures in hospitals throughout the region to comply with international standards. This project will increase the capacity of local counterparts to use radiotherapy techniques for the management of childhood diseases, cancer, coronary artery disease and degenerative disorders.

Hungarian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972, nine Hungarian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMANITARIAN DEMINING

In addition to promoting human health and sustainable development, nuclear techniques are proving to have important applications in almost every facet of human life. *One of such applications that is beginning to show increasing promise is the use of nuclear techniques for humanitarian demining purposes.*



It is estimated that more than 60 million landmines are buried in 62 countries, many of them in the Europe region. Abandoned landmines kill or injure about 26,000 persons every year, 80 percent of them civilians, mainly women, children, and farmers. Currently, most humanitarian demining is done using conventional methods such as metal detectors, prodders, and sniffer dogs, making the process of destroying abandoned landmines slow and dangerous. Results of various tests show that nuclear techniques have strong potential for identification of explosives in landmines. *In 2001, the U.S. began supporting a Regional Europe Project in Hungary that is field-testing and demonstrating the suitability of nuclear equipment for humanitarian demining.* If successful, this project would pave the way for wide-scale application of nuclear methods for demining purposes.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Hungarian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1976, approximately 112 Hungarians participated in 71 training courses hosted by the U.S.*
- *From 1960-2002, the U.S. accepted 82 Fellows and 66 Scientific Visitors from Hungary, 44 of which were fully funded by the U.S.*

Hungarian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Medicine* – U.S. National Institute of Health
- *Plant Breeding* – Cornell University
- *Radiation Protection* – U.S. Nuclear Regulatory Commission
- *Isotope Hydrology* – U.S. Geological Survey
- *Nuclear Safety* – Argonne National Laboratory



IAEA/ANL Training Course On:
Train the Trainers Course on Nuclear Safety

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Hungary have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1974, eight Hungarian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 11 Hungarians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 290 Hungarians have either visited or been assigned to U.S. Government facilities, and over 320 U.S. officials have visited Hungary.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Hungary since 1973. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND INDONESIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Indonesia in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Seibersdorf Plant Breeding Unit. The use of nuclear techniques in plant breeding and genetics can help improve crop yield, thus increasing the income of local farmers. (Credit: Dean Calma/IAEA)

The IAEA has been implementing a TC project in the area of Plant Breeding and Genetics to develop

commercially viable varieties of horticultural crops such as cut flowers, garlic, and citrus. Nuclear techniques are being used to improve crop yield, thus increasing the income of local farmers and improving economic conditions by creating additional employment opportunities.

Agriculture Fellowships and Training in the U.S.

Since 1958, 102 Indonesian Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

Since 1988, Indonesian counterparts have participated in five training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The emergence of drug resistant (DR) and multi-drug resistant (MDR) strains of tuberculosis (TB) in Indonesia poses serious challenges to the control of TB in the country. The IAEA is currently implementing a TC project in Indonesia to use isotopic molecular techniques to identify and provide molecular epidemiology for DR and MDR strains of TB. This information is essential for the diagnosis and treatment of TB and will contribute to the success of Indonesia's national TB Control Program.

The IAEA is also implementing a TC project in Indonesia to develop a radiotherapy center on Borneo Island. This project will improve the capacity of Indonesia to provide radiotherapy treatment services to cancer patients.

Indonesian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1973, four Indonesian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY



Credit: R. Faidutti/UN FAO

Through IAEA Technical Co-operation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management

programs by providing information on sources, movement, and quantity of water in a variety of environments.

In Indonesia, the IAEA is implementing a TC project to develop groundwater resources in the Gunung Kidul area. Nuclear techniques are used to extract freshwater from groundwater sources. This helps to support sustainable development of agriculture and enhance the socioeconomic status of farmers and other residents in the area. A similar Regional Asia and Pacific TC project is also underway that is using isotopic techniques to manage and protect drinking water.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Indonesian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, approximately **116 Indonesians** have participated in **72 training courses** hosted by the U.S.
- From 1958-2004, the U.S. has accepted **205 Fellows** and **47 Scientific Visitors** from Indonesia. **Of these Fellows, 113 were fully funded by the U.S.**

Indonesian Fellows and Scientific Visitors have trained along side U.S. counterparts at the following institutions:

- **Stanford University**
- **Cornell University**

- **Argonne National Laboratory**
- **Oak Ridge National Laboratory**
- **Texas A&M University**
- **U.S. Nuclear Regulatory Commission**
- **U.S. Geological Survey**
- **National Oceanic and Atmospheric Association (NOAA)**

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Indonesia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1963, 16 Indonesian students received Ph.D.'s from U.S. universities in the area of nuclear studies, and an additional 13 Indonesians received Ph.D.'s in the field of physics.



Credit: Argonne National Laboratory

OFFICIAL VISITS

For the past 15 years, over 130 Indonesians have either visited or been assigned to U.S. Government facilities, and over 100 U.S. officials have visited Indonesia.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Indonesia since 1982. Such exchanges have provided technical assistance in the areas of radiation transport and safety. Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND JAMAICA

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Jamaica in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



(Source: David Kinley -IAEA)

The U.S. is currently supporting a TC project in Jamaica that is working to eradicate the New World Screwworm (NWS) using the sterile insect technique (SIT). According to a 1997 economic impact assessment, problems caused by the existence of the NWS are estimated to cost the country between US \$5.5-7.7 million annually. These losses include livestock mortality, continuous costs of medication, labor for animal inspection, and preventative and curative treatment. NWS infestation also poses a risk to human health. Use of SIT and other conventional methods to reduce and eventually eradicate this insect pest will result in increased livestock output, improved trade opportunities as well as improved health conditions for the local population.

Agriculture Fellowships and Training in the U.S.

- *Since 1970, Jamaican Fellows, Scientific Visitors and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1981, Jamaican counterparts have participated in entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Vadim Mouchkin/IAEA)

IAEA health-related projects in Jamaica have focused on the establishment and improvement of nuclear medicine diagnostic capabilities.

Jamaican Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1974, two Jamaican physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

The IAEA recently initiated a TC project in Jamaica that is using isotope hydrology techniques to determine the source of contamination in the vicinities of bauxite and alumina plants in Jamaica. Jamaica is a leading producer of bauxite and alumina; however, during the production process, a caustic waste product is released. Water contaminated by this waste cannot be used for domestic and irrigation purposes, as it affects human health as well as soil quality and plant growth. This project aims to obtain information on the sources of the contamination, develop a strategy for water resources management, and increase the country's safe water supply.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Jamaican counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1976, approximately 13 Jamaicans participated in 10 training courses hosted by the U.S.*
- *Since 1971, the U.S. accepted three Fellows and Scientific Visitors from Jamaica.*

TRAINING IN THE U.S.

Jamaican Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Radiation Protection* – Argonne National Laboratory
- *Entomology* – University of Florida
- *Plant Breeding & Genetics* – U.S. Department of Energy



(Source: David Kinley -IAEA)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Jamaica have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, three Jamaican students received Ph.D.'s from U.S. universities in the area of physics and an additional two Jamaicans received degrees in nuclear fields.

OFFICIAL VISITS

For the past 15 years, over 65 Jamaicans have either visited or been assigned to U.S. Government facilities, and nine U.S. officials have visited Jamaica.

THE UNITED STATES AND JORDAN

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Jordan in support of these efforts, both bilaterally and through the IAEA.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: R. Faidutti/UN FAO

The IAEA has been implementing two TC projects in Jordan to help address the country's water shortage problems. The first project is a study on the feasibility of using radiation processing to recycle wastewater for use in irrigation in order to increase the amount of water available to farmers without depleting freshwater sources. The second project aims to contribute to water resource management in Jordan by strengthening the capacity of Jordan's existing isotope hydrology laboratory.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: IAEA

With the help of a USAID contribution, the IAEA has been implementing a series of TC projects in Jordan on using the Sterile Insect Technique (SIT) to eradicate the harmful Mediterranean Fruit Fly (Medfly). Efforts have already been underway in the **Arava**

Valley and the **Lower Jordan Valley**, and the IAEA has begun implementing a new TC project in Jordan to expand these efforts to the fruit producing areas north of the Jordan Valley. This will lead to a decrease in fruit and vegetable losses due to the Medfly.

Agriculture Fellowships and Training in the U.S.

In 1997, a Jordanian was awarded a scientific visit in the field of plant breeding and genetics at Purdue University.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiei/IAEA

The **Al-Bashir Hospital** is one of largest hospitals in Jordan, diagnosing and treating over 15,000 patients yearly. The IAEA is

implementing two TC projects in Jordan to strengthen nuclear medicine capabilities at Al-Bashir Hospital. The first project seeks to update the hospital's obsolete equipment with single photon emission computed tomography (SPECT) technology. The goal of the second project is to use vivo dosimetry to strengthen the quality assurance of the hospital's cancer management program.

Jordanian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1990, four Jordanian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Jordanian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1980, approximately **30 Jordanians** participated in **20 training courses** hosted by the U.S.
- From 1976-2004, the U.S. **accepted 21 Fellows** and **4 Scientific Visitors** from Jordan. **Of these Fellows, 8 were fully funded by the U.S.**
- Since 1993, **16 U.S. experts** provided services in Jordan in nuclear engineering, agriculture, industry and hydrology, and safety in nuclear energy.

Jordanian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Nuclear Radiochemistry** – Florida State University
- **Radiotherapy** – Mallinckrodt Institute
- **Radiation Protection** – Argonne National Laboratory
- **Sterile Insect Technique** – University of Florida
- **Medical Physics** – Rutgers University



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Jordan have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1964, 24 Jordanian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 22 Jordanians received Ph.D.'s in the field of physics.

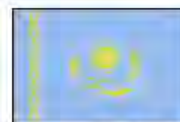
OFFICIAL VISITS

For the past 15 years, over 100 Jordanians have either visited or been assigned to U.S. Government facilities.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Exchanges of computer codes and related technical assistance have occurred between the U.S. and Jordan since 2002. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND KAZAKHSTAN THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Kazakhstan in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Argonne National Laboratory)

Radioimmunoassay (RIA) is an accurate technique for clinical pathological diagnosis which is being used in mass health-screening programs. **The Republican Research Centre of Mother and Child Health Care plans to cooperate with the Institute for Nuclear Physics (INP), Almaty, to develop a local capability to formulate thyroxine (T4), thyroid stimulating hormone (TSH), and PSA RIA/immunoradiometric assay (IRMA) kits to meet the increasing clinical need of nuclear medicine community in Kazakhstan.** The result of the project will improve local capability for reagent formulation. This will lead to strengthening and expansion of RIA clinical diagnosis services in an increasing number of laboratories with a positive effect on the national healthcare system.

RIA is also used in detecting "tumor marker molecules" of certain types of cancer. With the support from the IAEA, a regional TC project on detection and management of cancer is currently under way to help in the establishment of a common protocol for the cost

Nuclear Medicine Fellowships in the U.S.

- *Since 1998, three Kazakhstani Fellows have trained in the U.S. in the areas of nuclear medicine and radiotherapy.*

effective diagnosis and management of cancers through RIA, in combination with other diagnostic clinical parameters. Reliable information on the prevalence of various types of cancer in the participating Member States will contribute significantly to the cancer registry data of the region.

The IAEA is currently supporting a nuclear medicine-related Technical Cooperation project in Kazakhstan that will help the country in upgrading and equipping laboratory facilities for the production of Tc-99m and I-131 based radiopharmaceuticals in accordance with Good Manufacturing Practices. The local availability of these widely used radiolabelled products will increase the cost-effectiveness of nuclear medicine services in the country, reduce waiting time for treatment, and benefit more patients.

A project entitled "Cyclotron Production of Radionuclides for Medical and Industrial Use" is also on-going to improve the application of the existing cyclotron facility for the production of radionuclides, Co-57 and Cd-109 which are in considerable demand for use in the calibration of nuclear medicine equipment, dosimeters and in the mining and oil industries.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Vadim Mouchkin/IAEA)

The U.S. is currently supporting several regional TC projects in such areas as strengthening of regional preparedness and response of nuclear emergencies, physical protection and security of nuclear materials, safety review of research reactor facilities and legislative assistance for utilization of nuclear energy.

The IAEA is also supporting a nuclear safety-related TC project in the preparation of a decommissioning plan for the BN-350 reactor. As a result of the project, a comprehensive peer-reviewed decommissioning plan will outline the tasks, resources, and time needed to place the BN-350 fast breeder reactor in a "SAFESTOR" condition.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Kazakhstani counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1993, approximately 33 Kazakhstanis participated in 22 training courses hosted by the U.S.*
- *From 1996-2003, the U.S. accepted 16 Fellows and 13 Scientific Visitors from Kazakhstan.*
- *Since 1995, U.S. experts have provided services in Kazakhstan in the areas of safety in nuclear energy, nuclear engineering and technology and prospecting, mining and processing of nuclear materials.*

Kazakhstani Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Medicine* – Baylor College of Medicine
- *Irradiation Effects* – University of Illinois-Champaign

- *Radiation Protection* – Argonne National Laboratory
- *Ground-water Hydrology* – U.S. Geological Survey



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Kazakhstan have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 20 years, numerous Kazakhstanis have either visited or been assigned to U.S. Government facilities, and over 100 U.S. officials have visited Kazakhstan.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Kazakhstan since 1996. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety. Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND KENYA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Kenya in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



(Laboratory for the rearing of sterilized tsetse flies. Source: David Kinley/IAEA)

The U.S. is currently supporting a Technical Cooperation Project in Kenya that is employing an Africa-wide eradication approach to alleviate the persistent problem of tsetse infestation. The tsetse fly is a carrier of the disease trypanosomiasis, commonly known as sleeping sickness. This disease, a leading cause of loss of human life in Africa, also attacks livestock, killing as many as 3 million of such animals each year, and resulting in economic losses of more than \$4 billion annually. *The eradication of tsetse flies will not only improve the quality of human life, but will also make more land available for crop and livestock production, thereby contributing to food security and sustainable growth in the rural economy.*

Agriculture Fellowships and Training in the U.S.

- *Since 1980, 20 Kenyan Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1986, Kenyan counterparts have participated in five training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

In 1993, the U.S. began supporting a human health-related TC project to establish and improve nuclear medicine services at **Kenyatta National Hospital**. Through this project, the hospital was supplied with training and equipment for clinical diagnosis and research.

Kenyan Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1974, five Kenyan Physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

In 1999, the U.S. began supporting a Technical Cooperation project to improve sustainable development of groundwater resources by focusing on the long-term performance of the water sector in Kenya and several other sub-Saharan countries. This project is enabling water authorities and end users to devise appropriate policies and strategies for optimum management of the existing resources. The project is expected to have important social and economic impact by providing better access to clean and reliable water supplies for people in Kenya and throughout the region.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Kenyan counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1983, approximately 18 Kenyans participated in 14 training courses hosted by the U.S.*
- *From 1975-2002, the U.S. accepted 63 Fellows and 3 Scientific Visitors from Kenya, 52 of which were fully funded by the U.S.*
- *For the past 30 years, U.S. experts made over 17 exchange missions to Kenya to assist in the implementation of IAEA Technical Cooperation projects with a focus on projects dealing with the application of isotopes and radiation in agriculture, medicine and industry, and hydrology.*

TRAINING IN THE U.S.

Kenyan Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Medical Research* – U.S. National Institute of Health
- *Radiation Protection* – Oak Ridge National Lab
- *Soil Science & Irrigation* – University of California
- *Agricultural Biochemistry* – U.S. Department of Agriculture



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Kenya have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 10 years, over 20 Kenyans have either visited or been assigned to U.S. Government facilities, and over 45 U.S. officials have visited Kenya.

THE UNITED STATES AND KUWAIT

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Kuwait in support of these efforts, both bilaterally and through the IAEA.



ISOTOPE HYDROLOGY



Credit: R. Faidutti/UN FAO

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids

national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.

The IAEA is implementing a TC project in Kuwait that uses isotopic techniques to study the groundwater resources of the **Rawdatain field**. A better understanding of the recharge rate, causes of salinity and effectiveness of artificial recharge efforts will enable the country to develop a strategy to manage water resources in this region. This in turn will help ensure a freshwater supply for the people of Kuwait.

concern about the impact NORM waste has on the environment and the public. To address this issue, the IAEA has been implementing a TC program in Kuwait that uses nuclear techniques to monitor and assess the distribution and environmental impact of NORM waste. This will help the Kuwaiti government develop a waste management approach that will benefit the public and the environment.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Kuwaiti counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- In 1997, two Kuwaitis participated in a Workshop on Enhanced Electricity System Analysis and Planning, hosted by Argonne National Laboratory.

INDUSTRY AND ENVIRONMENT



Credit: Siemens/AG

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.

Naturally occurring radioactive material (NORM) waste is generated by the oil industry. In Kuwait, there is growing



IAEA/ANL Technical Committee Meeting/Workshop on
Enhanced Electricity System Analysis and Planning
1 December – 12 December 1997

Credit: Argonne National Laboratory

Kuwait is encouraged to continue to apply for IAEA fellowships and to participate in IAEA training courses held in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Kuwait have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, two Kuwaiti students received Ph.D.'s from U.S. universities in the area of nuclear studies and a Kuwaiti received a Ph.D. in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 18 Kuwaitis have either visited or been assigned to U.S. Government facilities, and over 22 U.S. officials have visited Kuwait.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Exchanges of computer codes and related assistance have occurred between the U.S. and Kuwait since 1981. Such exchanges have provided assistance in a variety of technical areas.

THE UNITED STATES AND KYRGYZSTAN THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to cooperation with Kyrgyzstan in support of these efforts, both bilaterally and through the IAEA.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Vadim Mouchkin/IAEA)

The IAEA is currently supporting a nuclear safety-related regional TC project on "Upgrading Radiation Protection Infrastructure and Compliance with the International Basic Safety Standards" in which Kyrgyzstan has participated. The intention of the project is to establish or upgrade infrastructure to a level commensurate with the extent of the radiation practices in the country which would ensure compliance with the principal requirements of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources.

The IAEA could provide assistance to Kyrgyzstan, if approved, in the following areas:

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Argonne National Laboratory)

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: WSSD Brochure/U.S.AID, DOE & DOS)

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Kyrgyzstani counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools could also be possible.

Kyrgyzstani Fellows and Course Participants could train with U.S. counterparts in a variety of U.S. institutions.



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

The following cooperative arrangements between the U.S. and Kyrgyzstan have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 15 years, Kyrgyzstanis have either visited or been assigned to U.S. Government facilities, and some U.S. officials have visited Kyrgyzstan.

THE UNITED STATES AND LATVIA

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Latvia in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Argonne National Laboratory)

Latvia is currently conducting a study to evaluate a feasibility of establishing a positron emission tomography (PET) centre at the **Latvia Oncology Centre (LOC)**. PET is a non-invasive advanced nuclear medicine imaging technique which is widely used in the fields of cardiology (detection of cardiac lesions), oncology (detection of cancer), neurology (detection of brain tumors and Alzheimer's disease), and neuropsychiatry. As a result of the project, the government will be able to make an informed decision whether PET centre can be established.

Latvia is also participating in two regional Europe TC projects in the areas of nuclear medicine and quality assurance/quality control (QA/QC) in radiation oncology. The results of the projects will benefit the country's healthcare system.



(Source: IAEA)

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Petr Pavlicek/IAEA)

Nuclear Safety Training in the U.S.

In addition to support for the above projects, since 1995, Latvia counterparts have participated in 7 training courses and 2 fellowships in the areas of Nuclear Safety, Radiation Protection, and Waste Management.

The U.S. is currently supporting two regional Europe TC projects in which Latvia is participating. The projects are in the areas of strengthening of regional preparedness and response of nuclear emergencies, and physical protection and security of nuclear materials. The U.S. also supported a completed regional Europe TC project in the area of emergency preparedness. The results of the project have increased the effectiveness in emergency preparedness and response organizations and plans.

As one of the 52 participating Member States in a project on upgrading radiation protection infrastructure supported partly by the U.S., Latvia has declared attainment of all five milestones. At its request, Latvia will be reviewed by peer missions to confirm its full compliance with the project's objective.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Latvian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *From 1995-2003, approximately 7 Latvians participated in 7 training course hosted by the U.S.*
- *Since 1998, the U.S. accepted 2 Fellows from Latvia.*
- *Since 1997, there have been 8 expert missions for projects in the areas of Nuclear Engineering and Technology and Safety.*

Latvian Fellows and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Radiation Protection* – Argonne National Laboratory
- *Safety in Nuclear Energy* – Sandia National Laboratory
- *Safety Standards, Regulations and Procedures* – Argonne National Laboratory



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Latvia have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 15 years, approximately 10 Latvians have either visited or been assigned to U.S. Government facilities, and many U.S. officials have visited Latvia.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Several exchanges of computer codes and related technical assistance have occurred between the U.S. and Latvia since 1997. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND LEBANON

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Lebanon in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE



Credit: Argonne National Laboratory

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity

Lebanon has been participating in an Interregional TC project on using the sterile insect technique (SIT) to control insect pests. This project will help increase public awareness of the benefits of SIT as an environmentally friendly means for controlling insect pests. The U.S. has contributed over \$180,000 in extrabudgetary funds to support this project.

The IAEA also recently completed two TC projects in Lebanon in agriculture. Both projects focused on lessening the impact of pesticides on the environment and the public. Nuclear techniques were used to analyze pesticide residues in agricultural products in one project. Through the introduction of the SIT, the other project introduced an alternative to pesticides to control fruit tree pests.

Agriculture Fellowships and Training in the U.S.

Since 1964, 8 Lebanese Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, agricultural biochemistry, soil science, food preservation, animal production and fisheries and entomology.

HUMAN HEALTH



Credit: Petr Pavlicek/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such

as cancer and malaria.

Lebanon has been participating in a Regional Asia and the Pacific TC project on using radioimmunoassay (RIA) technology to detect and manage prostate and breast cancers. RIA technology is considered one of the most sensitive and cost-effective ways of detecting and measuring changes in tumors.

Lebanese Nuclear Physicians Certified in U.S.

In addition to support for the above projects, four Lebanese Physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Rainfall is an important source of freshwater recharge (Credit: Rodolfo Quevenco/IAEA)

Lebanon has been participating in a Regional Asia and the Pacific TC project that uses isotope hydrology and geochemical techniques to study the feasibility of artificial recharge of groundwater in areas where rainwater and surface runoff are lost due to high evaporation rates and geological and environmental conditions. This project is examining the possibility of artificially recharging aquifers by storing rainwater and surface runoff during humid water years.

The IAEA also completed a TC project in Lebanon on the study of underground water resources. This project used isotope hydrology techniques to estimate the amount of groundwater sources and the recharge rate and to assess the contamination of aquifers by seawater.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Lebanese counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1996, **four Lebanese** have participated in **four training courses** hosted by the U.S.
- From 1964-2004, the U.S. has accepted **nine Fellows** from Lebanon. **Of these Fellows, three were fully funded by the U.S.**
- In 1999, **U.S. experts** provided services in Lebanon in groundwater hydrology and analytical chemistry.

Lebanese Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Radiation Protection** – Argonne National Laboratory
- **Soil Science and Irrigation** – University of Wisconsin, Madison
- **Agricultural Biochemistry** – U.S. Department of Agriculture



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Lebanon have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958, 7 Lebanese students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 21 Lebanese received Ph.D.'s in the field of physics.

OFFICIAL VISITS

Since 1986, over 100 Lebanese have either visited or been assigned to U.S. Government facilities.

THE UNITED STATES AND LITHUANIA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Lithuania in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



(Source: Argonne National Laboratory)

Brucellosis in sheep and goats is a zoonotic disease that affects humans and animals through consumption of milk and milk products. This disease presents in all Mediterranean countries, including the region of the Balkans.

To deal with this problem, the IAEA initiated a regional Europe TC project that is using the enzyme linked immunosorbent assay (ELISA) technique as well as polymerase chain reaction (PCR) to improve control of the Brucellosis in sheep and goats through the establishment of regional collaboration of Member States affected by the disease, to set up a laboratory network using isotope-based technology, to detect Brucellosis antibodies, and to implement methods for the certification of milk and milk products as safe for human consumption.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Argonne National Laboratory)

The IAEA is currently supporting a nuclear medicine-related Technical Cooperation project in Lithuania that is improving the effectiveness of radiotherapy services for the treatment of cancer at the **Lithuanian Oncological Centre** and bringing it to the standard of a Centre of Competence. The Centre will be able to administer up-to-date cancer treatment with modern equipment. Cancer patients will receive radiotherapy treatment safely and economically at an internationally accepted level.

Nuclear Safety Training in the U.S.

Since 1998, 28 out of 36 Lithuanian Fellows and Scientific Visitors have trained in the U.S. in the areas of radiation and environmental protection, safety standards and procedures and radioactive waste management.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Vadim Mouchkin/IAEA)

The U.S. is currently supporting a safety standards and procedures-related Technical Cooperation project in Lithuania to strengthen the effectiveness of the nuclear safety authority in Lithuania (VATESI) and establish a training program in radiation protection at the Radiation Protection Centre. This project will result in enhancing the ability of both authorities to respond to new regulatory challenges relating to the licensing of Ignalina NPP, unit 2 and decommissioning of Ignalina NPP, unit 1.

The U.S. is also supporting several regional Europe TC projects in such areas as strengthening of regional preparedness and response of nuclear emergencies, physical protection and security of nuclear materials, strengthening management of operational safety at nuclear power plants (NPPs) and utility organization and strengthening safety assessment capabilities of NPPs.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Lithuanian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1994, approximately 47 Lithuanians participated in 25 training courses hosted by the U.S.*
- *From 1998-2003, the U.S. accepted 20 Fellows and 16 Scientific Visitors from Lithuania, 4 of which were fully funded by the U.S.*

Lithuanian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Power Reactors** – Sonalysts, Inc.
- **Radiation Protection** – Oak Ridge Institute for Science and Education
- **Safety Evaluation** – Brookhaven National Laboratory
- **Safety in Nuclear Energy** – Sandia National Lab.
- **Safety of Reactors and Nuclear Materials** – Argonne National Laboratory



IAEA/ANL Interregional Training Course on:
Emerging Nuclear Safety Issues for Decision Making

(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Lithuania have occurred on a direct, bilateral basis:

OFFICIAL VISITS

In the past 20 years, more than 10 Lithuanians have either visited or been assigned to U.S. Government facilities, and over 20 U.S. officials have visited Lithuania.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Several exchanges of computer codes and related technical assistance have occurred between the U.S. and Lithuania since 1997. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND MALAYSIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Malaysia in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



In Malaysia, susceptibility to pests and diseases poses a major challenge to the country's rice industry. In 1986, the U.S. began supporting a project that used nuclear techniques to improve crop yield and resistance to disease. The success of this project led to the expanded use of nuclear techniques in other areas of the agriculture sector. A similar TC project is currently underway to develop new varieties of horticultural crops with increased adaptability to drought, salinity and other environmental constraints.

Agriculture Fellowships and Training in the U.S.

Since 1978, 71 Malaysian Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

Since 1986, Malaysian counterparts have participated in five training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radio-isotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



Credit: Vadim Mouchkin/IAEA

One of such projects currently underway is expanding nuclear medicine services at **Penang Hospital**. This hospital serves residents

from four states with a total population of over 4 million and, in recent years, has seen a steady increase in the number of patients needing nuclear medicine treatment. *This project is introducing new radiotherapy equipment as well as training additional nuclear medicine physicians and therapists to meet the hospital's growing demands.*

Malaysian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1976, three Malaysian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: R. Faidutti/UN FAO

An IAEA TC project currently underway is using nuclear techniques for **Protection and Management of Water Resources**. This project is assessing the impact of industrial and municipal landfill operations on groundwater and surface water sources. A similar **Regional Asia and Pacific** project is using nuclear techniques to assess the pollution vulnerability of water resources in urbanized and industrialized areas. **Both projects are aimed at protection and better management of the country's water supply.**

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Malaysian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, approximately **70 Malaysians** participated in **52 training courses** hosted by the U.S.
- From 1973-2004, the U.S. accepted **119 Fellows** and **59 Scientific Visitors** from Malaysia. Of these Fellows, **45 were fully funded by the U.S.**
- For the past 20 years, U.S. experts made **over 82 exchange missions** to Malaysia to assist in the implementation of IAEA Technical Cooperation projects.

Malaysian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts at numerous U.S. institutions in a variety of technical areas, including:

- **Radiation Protection** – Brookhaven National Laboratory
- **Food Preservation** – U.S. Department of Agriculture
- **Nuclear Medicine** – Stanford University
- **Research Reactors** – Massachusetts Institute of Technology
- **Nuclear Safety** – Argonne National Laboratory



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Malaysia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1963, 20 Malaysian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 15 Malaysians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 145 Malaysians have either visited or been assigned to U.S. Government facilities, and 22 U.S. officials have visited Malaysia.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Malaysia since 1975. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND MALI

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Mali in support of these efforts.



AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: Vadim Mouchkin/IAEA

Mali is heavily dependent on agriculture for its economic development. The presence of a species of tsetse fly in the **Northern Niger River Basin** region presents an obstacle to livestock production and export. In an effort to address this, the IAEA is implementing a TC project in Mali to study the feasibility of creating a tsetse-free zone. The collection of baseline data is necessary for the development of a viable project to eradicate the tsetse fly from this region. Mali also participates in a Regional

Africa TC project on the use of the Sterile Insect Technique (SIT) to manage the tsetse fly and trypanosomiasis in Africa.

Agriculture Fellowships and Training in the U.S.

Since 1982, nine Malian Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of animal diseases and entomology.

HUMAN HEALTH



Credit: Petr Pavlicek/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The **Point G Hospital in Bamako** is the only hospital in the country with a nuclear medicine infrastructure; however its capabilities are limited, and many patients must travel abroad for further treatment. In order to address this, The IAEA is implementing a TC project to upgrade the nuclear medicine capabilities of the Point G Hospital through the introduction of a single photon emission computed tomography (SPECT) gamma camera. This new imaging facility will enable the hospital to diagnose and treat more patients from Mali and abroad. The Agency is also assisting Mali to conduct a feasibility study for the establishment of a national radiotherapy center at the Point G Hospital.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: R. Faidutti/UN FAO

The **Iullemeden Aquifer System** covers over 500,000 square kilometers and is shared by Mali, Niger and Nigeria. Mali is participating in a Regional Africa TC project on the development of water resources in the Iullemeden Aquifer System. The IAEA, together with other relevant international agencies, is using isotope hydrology methods to investigate the aquifer system. Information such as the recharge and flow rate and the impact of pollution will be used to establish a common database and information system that will enable all three countries to develop policies for sustainable exploitation of the aquifer system.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Malian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1994, **seven Malians** have participated in **six training courses** hosted by the U.S.
- From 1982-2004, the U.S. has accepted **15 Fellows** and two **Scientific Visitors** from Mali.

Of these Fellows, six were fully funded by the U.S.

- Since 1981, **U.S. experts** have provided services in Mali in nuclear medicine, plant breeding and genetics, and isotope hydrology.

Malian Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Groundwater Hydrology** – Argonne National Laboratory
- **Nuclear Medicine** – National Institute of Health
- **Animal Diseases** – University of California



Credit: Argonne National Laboratory

THE UNITED STATES AND MALTA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

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HUMAN HEALTH



Credit: Massoud Samiei/IAEA

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and

treatment of diseases such as cancer and malaria.

The **Sir Paul Boffa Hospital** in Malta is the only public hospital in the country that serves radiotherapy patients. The Agency is implementing a TC project to improve the quality assurance in radiotherapy at the hospital. Full diagnostic computed tomography (CT) scanning and a 3D planning service will be made available. This upgrade will lead to improved treatment planning for cancer patients.

Malta is participating in two additional IAEA TC projects in the area of human health. One of these projects aims to develop and expand nuclear cardiology capabilities. This will improve the quality of diagnosis and, in turn, will help increase the quality of life and life expectancy of cardiac patients in Malta. The second project focuses on setting up a program for the radiation protection of patients in diagnostic radiology. Such a program will help ensure that patients are receiving the lowest possible radiation dose while at the same time maintaining the quality of x-ray diagnostic procedures.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container (Credit: IAEA)

Malta has been participating in several country and Regional Europe TC projects in such areas as emergency preparedness and response to radiological emergencies, radionuclide monitoring, occupational radiation protection, radiation and waste safety, transport safety, and regaining control of "orphan sources."

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- **Eradicating and controlling insects**
- **Increasing the yield, quality and disease resistance of crops**
- **Improving the quality of food and protection from spoilage and losses**
- **Promoting animal health and productivity**



Credit: Argonne National Laboratory

The IAEA completed two IAEA TC projects in Malta in the area of agriculture. In both projects, the Agency worked with Malta's **Veterinary Services Diagnostic Laboratory** to ensure the quality of livestock and livestock products. Nuclear techniques were used to test for veterinary drug residues and other contaminants, such as heavy metals and pesticides, in order to increase the level of food safety and meet EU and international standards.

Agriculture Fellowships and Training in the U.S.

In 2001, a Maltese participated in an Interregional Training Course hosted by the University of Florida on the Use of the Sterile Insect and Related Techniques for the Integrated Area-wide Management of Insect Pests.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Maltese counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- In 1995 and 2001, U.S. experts provided services in Malta in entomology and the legal aspects of atomic energy.

Malta is encouraged to continue to apply for IAEA fellowships and to participate in IAEA training courses held in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

THE UNITED STATES AND MEXICO

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Mexico in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Larval trays for mass production of fruit flies (Credit: Lindquist/IAEA)

Mexico is a year round producer and exporter of tropical and temperate fruits. However, the Anastrepha fruit fly is an ever present challenge to the fruit industry. For the past twenty years, Mexico has been using integrated SIT to control the fruit fly population. The IAEA is currently implementing a TC project in Mexico to help expand the use of this technology to other regions of Mexico, thereby

allowing for greater fruit exports. The IAEA has also begun implementing a TC project in Mexico on using SIT to prevent the introduction of the Cactus Moth into Mexico by placing a barrier of sterile insects on the borders with Florida and Alabama.

Agriculture Fellowships and Training in the U.S.

Since 1959, 29 Mexican Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

IAEA health-related projects in Mexico have focused on strengthening the use of medical physics for national health services, the provision of radiation sources and equipment, personnel training in medical physics and safety, and the establishment and proper maintenance of radiotherapy programs for cancer treatment.

Mexican Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972 11 Mexican Physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

INDUSTRY AND ENVIRONMENT

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



Credit: Siemens AG

The presence of a number of industries and approximately 3.5 million vehicles in Mexico City has contributed to the deterioration of air quality. To help address this problem, the IAEA has been implementing a TC project on the evaluation of airborne fine particles in Mexico City. An elemental analysis of these particles will be useful in identifying emission sources. This information will help local and federal authorities develop policies to control emissions and reduce air pollution levels in Mexico City to acceptable levels.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Mexican counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, approximately **183 Mexicans** have participated in **89 training courses** hosted by the U.S.
- From 1958-2004, the U.S. has accepted **145 Fellows** and **41 Scientific Visitors** from Mexico. **Of these Fellows, 88 were fully funded by the U.S.**

Mexican Fellows and Scientific Visitors have trained along side U.S. counterparts at the following institutions:

- Stanford University
- Cornell University
- Argonne National Laboratory
- Oak Ridge National Laboratory
- Texas A&M University
- U.S. Nuclear Regulatory Commission
- U.S. Geological Survey
- National Oceanic and Atmospheric Association (NOAA)

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Mexico have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958, 47 Mexican students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 35 Mexicans received Ph.D.'s in the field of physics.



Credit: Argonne National Laboratory

OFFICIAL VISITS

For the past 25 years, over 1060 Mexicans have either visited or been assigned to U.S. Government facilities, and over 738 U.S. officials have visited Mexico.

SISTER LAB AGREEMENT

In March 1982, the *Mexican National Institute of Nuclear Research (ININ)* and the *Los Alamos National Laboratory (LANL)* signed a memorandum of understanding for the exchange of technical information and cooperation in the field of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and ININ counterparts, facilitating various collaborative projects including:

- Exchange of scientific and technical information
- Short-term visits by expert teams or individuals
- Training of scientific and technical personnel through fellowships, seminars or courses

Current cooperation is focused on the modeling of accidental radioactive releases from power reactors and the characterization and reclamation of Mexico's low-level radioactive waste disposal site.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Mexico since 1969. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND MONGOLIA



SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

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AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: Vadim Mouchkin/IAEA

Livestock production in Mongolia plays an important part in the country's economic development, comprising more than 30% of the gross domestic product. Infectious animal diseases, such as foot and mouth disease and rinderpest, hinder livestock production and exports. Mongolia has been carrying out a National Programme on Animal Health to control animal diseases. Through an IAEA TC project, the Agency has been assisting Mongolia's **Institute of Veterinary Medicine (IVM)** and **State Central Veterinary Laboratory (SCVL)** with developing and

ensuring quality control of diagnostic kits and reagents for the detection and diagnosis of infectious animal diseases. Through the provision of equipment, experts, training and scientific visits, the Agency is helping Mongolia to develop the domestic means to diagnose and control these diseases.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Argonne National Laboratory

The Agency has been implementing two TC projects in Mongolia in the area of human health. Through expert services, fellowship training, scientific visits and provision of equipment, the Agency is assisting the **National Cancer Center (NCC) in Ulaan Baatar** with developing a quality assurance program for radiotherapy. This will help to ensure safe treatment of cancer patients in Mongolia. The Agency is also assisting the **First State Central Clinic in Ulaan Baatar** to upgrade and expand its nuclear medicine services to provide early diagnosis and treatment for various disorders such as heart disease and cancer.

Mongolia is also participating in several IAEA Regional Asia TC projects in nuclear medicine imaging, radioisotope and radiation treatment, and radiation metrology and dosimetry.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: Argonne National Laboratory

The IAEA has been implementing a TC project in Mongolia to assist Mongolia's **Institute of Geocology** with using isotope techniques to evaluate contamination of the **Orkhon River Basin**. The Orkhon River is the longest river in Mongolia and is located in one of the country's populated regions. The quality of the river as a source of drinking water has degraded in recent years due to pollution caused by the mining industry and the use of chemical fertilizers. A better understanding of the river's source, recharge and discharge rates and the causes of contamination will help the government of Mongolia develop pollution control policies and better manage the water resources of the Orkhon River Basin.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Mongolian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1992, **7 Mongolians** have participated in **6 training courses** hosted by the U.S.
- From 1993-2004, the U.S. has accepted **11 Fellows** and **8 Scientific Visitors** from Mongolia. **Of these Fellows, 8 were fully funded by the U.S.**
- Since 1990, **8 U.S. experts** provided services in Mongolia in animal production and fisheries, plant breeding and genetics, analytical chemistry, nuclear medicine, and application of isotopes and radiation in medicine.

Mongolian Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Nuclear Physics** – Argonne National Laboratory
- **Nuclear Medicine** – University of Pennsylvania
- **Plant Breeding and Genetics** – Washington State University
- **Biology Applications of Radiation** – National Institute of Health



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the U.S. has cooperated with Mongolia on a direct, bilateral basis:

OFFICIAL VISITS

For the past 15 years, over 13 Mongolians have either visited or been assigned to U.S. Government facilities, and 8 U.S. officials have visited Mongolia.

THE UNITED STATES AND MOROCCO THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Morocco in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

The IAEA recently completed a Technical Cooperation project that improved Morocco's capability to diagnose and monitor animal diseases. Through this project, the **Animal Breeding Department of the Ministry of Agriculture and Agrarian Reform** strengthened the diagnostic capabilities of its regional veterinary laboratories by introducing nuclear and nuclear-related techniques. This project improved the country's capabilities to rapidly diagnosis and monitor major livestock diseases, particularly African horse sickness (AHS) and foot and mouth disease (FMD). *The project contributed to the successful eradication of AHS and helped to establish national FMD vaccination campaigns.*

Agriculture Fellowships and Training in the U.S.

- *Since 1993, eight Moroccan Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1992, Moroccan counterparts have participated in two training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



The U.S. is currently supporting a Regional Africa TC project that is strengthening Morocco's nuclear medicine capabilities. The project is establishing regional training programs in medical physics and developing quality assurance (QA) programs that ensure proper maintenance and calibration of radiotherapy equipment.

Nuclear Medicine Training in the U.S.

In addition to support for the above projects, since 1995, Moroccan counterparts have participated in numerous fellowships, scientific visits, and training courses in the areas of nuclear medicine, radiotherapy, medical physics, and radiopharmacy.

INDUSTRY

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



(Source: *World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS*)

In 1999, the U.S. began supporting a Technical Cooperation project on investigating dam and reservoir leakages. IAEA reviews showed that many member states lacked the capacity to investigate leaks of unknown origin effectively, resulting in a loss of precious water resources and also creating potential safety hazards to the surrounding population. This project is improving the capacity of local counterparts to address such leakages, thus improving the conservation and availability of water sources. The project has already demonstrated promise by successfully identifying the origins of serious leakages in the **Aoulouz Dam in Morocco**, resulting in savings of several million dollars.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Moroccan counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1981, approximately 38 Moroccans participated in 27 training courses hosted by the U.S.*
- *From 1991-2002, the U.S. accepted 34 Fellows and three Scientific Visitors from Morocco, 28 of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Moroccan Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Ground Water Hydrology** – Argonne National Lab
- **Food Preservation** – Iowa State University
- **Reactor Safety** – Nuclear Regulatory Commission
- **Radiation Protection** – Lawrence Livermore National Laboratory



(Source: *Argonne National Laboratory*)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Morocco have occurred on a direct, bilateral basis:

SISTER LAB AGREEMENT

In October 1994, the **Moroccan National Center for Nuclear Energy Sciences (CNESTEN)** and the **U.S. Department of Energy's Lawrence Livermore National Laboratory (LLNL)** entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and CNESTEN counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*

Current programs are focused on environmental monitoring and modeling, groundwater salinization, seismic design review, urban air quality research, and preparations for the construction of a TRIGA research reactor.

OFFICIAL VISITS

For the past 10 years, over 65 Moroccans have either visited or been assigned to U.S. Government facilities, and over 17 U.S. officials have visited Morocco.

THE UNITED STATES AND NAMIBIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

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ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Stock tank near Stampriet, Namibia (Credit: Andrew Weinberg, Bechtel-S Corp.)

The IAEA has been implementing a TC project in Namibia using isotope hydrological techniques to assess the yield and quality of water in the **Oshivelo and Kalahari Aquifers**. A better understanding of the quality, yield and recharge rate of these aquifers is helping Namibia to develop a water policy that will ensure better management of its water resources.

Namibia has also been participating in two Regional Africa TC projects on the use of isotopes in managing water resources. The first project focuses on developing the necessary expertise, skills and regional capacity for water resources management. The second project is aimed at developing regional capacity for addressing dam and

reservoir leaks in order to optimize conservation of water resources.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiet/IAEA

In Namibia an IAEA TC project, funded in part by an extra-budgetary contribution from the U.S., established a radiotherapy unit at **Windhoek Central Hospital**. Since its establishment, the number of patients receiving treatment annually has increased.

Namibia has also been participating in four regional Africa TC projects on the application of nuclear medicine techniques. These projects focus on improving the safety and effectiveness of radiotherapy practice and introducing new clinical techniques; managing common cancers in Africa; using nuclear medicine techniques to improve the overall healthcare in Africa; and establishing regional capacity in medical physics.

Since the establishment of the radiotherapy unit at Windhoek Central Hospital, the number of patients treated annually has increased by 50%.

AGRICULTURE

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increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- **Eradicating and controlling insects**
- **Increasing the yield, quality and disease resistance of crops**
- **Improving the quality of food and protection from spoilage and losses**
- **Promoting animal health and productivity**



Credit: Vadim Mouchkin/IAEA

Namibia is a major exporter of livestock products. However, diseases such as contagious bovine pleuropneumonia (CBPP) and foot and mouth disease are highly prevalent in the northern part of the country. The IAEA has been implementing a TC project in Namibia to develop a sustainable veterinary diagnostic service with the goal of strengthening Namibia's capacity to diagnose and combat these diseases.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Namibian counterparts work to build the capacity of local

leaders, by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 2002, **six Namibians** have participated in **three training courses** hosted by the U.S. on isotope hydrology.



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the U.S. is cooperating with Namibia on a direct, bilateral basis:

OFFICIAL VISITS

In the past 10 years, 3 Namibians have either visited or been assigned to U.S. Government facilities, and 2 U.S. officials have visited Namibia.

THE UNITED STATES AND NIGERIA

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Nigeria in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



(Source: Vadim Mouchkin/IAEA)

The U.S. is currently supporting a regional Africa technical cooperation project that is working with the **Organization of African Unity/Inter-African Bureau for Animal Resources (OAU/IBAR)** to develop diagnostic and surveillance programs using nuclear techniques to reduce the occurrence of major livestock diseases. Animal diseases cause high mortality rates in livestock, which threatens both quality and quantity of livestock products, reduces food supply, and discourages private investment in the sector. This program is working with local counterparts to correctly diagnose, monitor, and treat such diseases. The goal of the project is to increase production and food security, thus increasing output and improving trade opportunities.

Agriculture Fellowships and Training in the U.S.

- Since 1971, 24 Nigerian Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.
- Since 1986, Nigerian counterparts have participated in training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

Nuclear medicine facilities for the diagnosis and treatment of cancer are extremely limited in Nigeria. To improve services to cancer patients, the IAEA recently initiated a TC project that is

reactivating the nuclear medicine imaging services at the **Lagos University Teaching Hospital (LUTH)** and the **College of Medicine of the University of Lagos (CMUL)**. The new facilities will serve over 10 million people and take referrals from other member states, thus improving the quality and availability of cancer treatment services.

Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1983, Nigerian physicians have been certified to practice nuclear medicine from the **American Board of Nuclear Medicine**.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

In 2001, the IAEA began a TC project in Nigeria that is using isotope hydrology techniques to investigate the potential uses of groundwater resources in the **Chad Basin Aquifer**. The goal of the project is to evaluate the long-term uses of this water resource, thus allowing local counterparts to develop a reliable water resource management plan. Improved resource management is expected to improve the living conditions and the socio-economic development throughout this region.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Nigerian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1983, approximately 30 Nigerians participated in 21 training courses hosted by the U.S.*
- *From 1971-2002, the U.S. accepted 90 fellows and scientific visitors from Nigeria, 49 of which were fully funded by the U.S.*

EXPERT MISSIONS

In the past 25 years, U.S. experts made over 16 exchange missions to Nigeria to assist in the implementation of IAEA Technical Cooperation projects.

TRAINING IN THE U.S.

Nigerian fellows, scientific visitors, and course participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Nuclear Safety** – Argonne National Laboratory
- **Plant Breeding & Genetics** – Cornell University
- **Medical Physics** – Oak Ridge National Laboratory
- **Agricultural Biochemistry** – U.S. Department of Agriculture



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Nigeria have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, 12 Nigerian students received Ph.D.'s from U.S. universities in the area of nuclear studies, and an additional three Nigerians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 10 years, over 153 Nigerians have either visited or been assigned to U.S. Government facilities, and U.S. officials have visited Nigeria.

THE UNITED STATES AND PERU

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Peru in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



One of such projects, supported by the U.S., used nuclear techniques in the area of **Plant Breeding and Genetics** to improve food production and security in Peru and the surrounding region. This project utilized mutation breeding techniques to enhance the genetic make-up of rice and other cereals, making them less susceptible to disease, insect pest infestation, and adverse soil and climate conditions. *A similar project is currently underway that is focused on improving barley crops. Both projects are contributing to increased food supply and farm income in the Andean highlands and throughout Peru.*

Agriculture Fellowships and Training in the U.S.

- *Since 1959, 27 Peruvian Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Juanita Perez Vargas - IAEA)

The IAEA is currently implementing a TC project that is improving the country's cancer care system. This project is focused on infrastructure development, training, and provision of new equipment for diagnostic and treatment centers. These improvements

will assure that the Peruvian population at large will have access to local cancer detection and treatment services.

Peruvian Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1973, four Peruvian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

A regional Latin American project currently underway is using nuclear techniques to develop and implement sustainable groundwater management systems. Through this project, local counterparts are instituting policies and strategies that ensure an integrated and sustainable water resources management plan, assuring that 10 million people will have continued access to water resources.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Peruvian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1978, approximately 49 Peruvians participated in 30 training courses hosted by the U.S.*
- *From 1959-2002, the U.S. accepted 56 Fellows and 21 Scientific Visitors from Peru, 32 of which were fully funded by the U.S.*
- *In the past 25 years, U.S. experts made over 87 exchange missions to Peru to assist in the implementation of IAEA Technical Cooperation projects.*

TRAINING IN THE U.S.

Peruvian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Safety* – Argonne National Lab
- *Nutrition & Health* – Johns Hopkins University
- *Nuclear Physics* – U.S. Department of Energy
- *Nuclear Medicine* – U.S. National Institute of Health



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Peru have occurred on a direct, bilateral basis:

SISTER LAB AGREEMENT

In 1991, the *Peruvian Institute of Nuclear Energy (IPEN)* and the U.S. Department of Energy's *Los Alamos National Laboratory (LANL)* entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and IPEN counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*

Current programs are focused on radioactive waste management, development and application of a science-based atmospheric assessment competency, and the enhancement of IPEN's environmental monitoring program.

OFFICIAL VISITS

For the past 15 years, over 88 Peruvians have either visited or been assigned to U.S. Government facilities, and over 29 U.S. officials have visited Peru.

THE UNITED STATES AND THE PHILIPPINES THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with the Philippines in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



One of such projects, currently underway, is using nuclear **Plant Breeding and Genetic Techniques** to improve food security on the Philippine island of **Mindanao**. Fruit crops such as mangosteen and cashew are high-value tropical fruits and very important to the local economy. However, cashew production in Mindanao fluctuates year-to-year, depending on the severity of pest and disease damage, and mangosteen bears fruit only during a four-month peak period. As a result, the IAEA is working with local counterparts to develop new varieties of these important crops, which will increase the annual yield and improve the overall crop quality. The project will also develop new varieties of rice crops with increased resistance to pests and greater tolerance to environmental stresses. *The increased agricultural development as a result of this project is expected to greatly reduce poverty and improve the economic conditions on Mindanao.*

Agriculture Fellowships and Training in the U.S.

- Since 1960, 87 Philippine Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.
- Since 1988, Philippine counterparts have participated in three training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek - IAEA)

The IAEA is currently working with the **Philippine Department of Health** to expand the coverage of the national neonatal screening program for congenital

hypothyroidism (CH). Each year, fifteen percent of newborns have an iodine deficiency, the cause of CH. A neonatal screening program will contribute to early detection, diagnosis, and treatment of these children, which will improve the quality of life as well as prevent treatable mental retardation.

Philippine Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1972, 69 Philippine physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

In 2001, the IAEA initiated a Technical Cooperation project in the Philippines using nuclear techniques to improve the country's water resource management. Through this project, local counterparts will develop and implement appropriate policies and strategies for an integrated and sustainable water resources management plan, thus ensuring that the local population has long term access to water resources.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Philippine counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1976, approximately 107 Filipinos participated in 64 training courses hosted by the U.S.*
- *From 1960-2002, the U.S. accepted 331 Fellows and 48 Scientific Visitors from the Philippines, 169 of which were fully funded by the U.S.*
- *In the past 25 years, U.S. experts made over 75 exchange missions to the Philippines to assist in the implementation of IAEA Technical Cooperation projects.*

TRAINING IN THE U.S.

Philippine Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Safety* – Argonne National Lab
- *Food Preservation* – U.S. Department of Agriculture
- *Radiation Protection* – U.S. Department of Energy
- *Plant Breeding* – University of California
- *Nuclear Medicine* – Johns Hopkins Medical Institute



IAEA/ANL Basic Professional Training Course on Nuclear Safety

(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Philippines have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958, 12 Philippine students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 15 Filipinos received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 204 Filipinos have either visited or been assigned to U.S. Government facilities, and 17 U.S. officials have visited the Philippines.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and the Philippines since 1983. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND POLAND

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Poland in support of these efforts, both bilaterally and through the IAEA.



AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Seibersdorf Plant Breeding Unit. The use of nuclear techniques in plant breeding and genetics can help improve crop yield, thus increasing the income of local farmers. (Credit: Dean Calma/IAEA)

The IAEA recently completed a TC project in Poland that worked with local counterparts to increase food productivity using nuclear plant breeding and genetic techniques. Through this project, the IAEA and the Department of Genetics at Silesian University in

Katowice teamed together to develop new varieties of major crops with faster breeding times, higher yields, and improved resistance to disease and environmental constraints. The improved crop varieties are expected to directly benefit horticulturalists and farmers who will be able to reduce the use of expensive and environmentally undesirable fertilizers and pesticides.

Agriculture Fellowships and Training in the U.S.

Since 1961, 29 Polish Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, animal disease, animal production, entomology, food preservation, soil science, and plant breeding and genetics.

ISOTOPE HYDROLOGY



Credit: Rodolfo Quevenco/IAEA

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.

In the mid-1990's the IAEA worked with the **Institute of Physics and Nuclear Techniques in Krakow** to use isotope hydrology techniques to improve the investigation and protection of the country's groundwater resources. This program was particularly important in Poland because of the country's scarce water resources and the severe pollution of its surface waters. As a result of this collaboration, the Institute of Physics received the

necessary training and equipment to better manage the country's water resources.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good



Credit: Massoud Samiet/IAEA

health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The IAEA is currently implementing two TC projects in Poland to help improve the quality and availability of medical treatment at relatively low cost. In the first project, the IAEA is working with the **Institute of Applied Radiation Chemistry** to create, test and implement new polymeric materials for medicine.

In the second project, the IAEA is providing equipment and training on laser welding to help Poland develop welding techniques of miniaturized radiation sources to use in brachytherapy. Brachytherapy is used to treat malignant tumors. In this procedure, the radioactive source is placed in or near the tumor itself. This allows for the maximum dose of radiation to the tumor and minimizes the amount of damage to healthy tissue. The project will expand the application of brachytherapy in the country.

Polish Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972 11 Polish Physicians obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Polish counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, **101 Poles** have participated in **68 training courses** hosted by the U.S.
- From 1961-2004, the U.S. has accepted **100 Fellows** and **26 Scientific Visitors** from Poland. **Of these Fellows, 30 were fully funded by the U.S.**
- Since 1979, **58 U.S. experts** provided services in Poland in many areas such as radioactive waste management, quality assurance, analytical chemistry, pollution studies, radiation protection, economic aspects of atomic energy, security of material, and production and control of radiopharmaceuticals.

Polish Fellows, Scientific Visitors and course participants have trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Nuclear Engineering and Technology** – Argonne National Laboratory
- **Safety in Nuclear Energy** – Sandia National Laboratory
- **Food Preservation** – U.S. Department of Agriculture
- **Medical Physics** – Massachusetts General Hospital



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Poland have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1964, 13 Polish students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 30 Poles received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 20 years, over 900 Poles have either visited or been assigned to U.S. Government facilities, and over 450 U.S. officials have visited Poland.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Poland since 1972. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND QATAR



SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Qatar in support of these efforts, both bilaterally and through the IAEA.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container (Credit: IAEA)

The Central Environmental Laboratory (CEL) at Qatar's Supreme Council for the Environment and Natural Reserves (SENCR) is responsible for monitoring the level of radioactivity concentrations in food and the environment. The IAEA has been implementing a TC project in Qatar to strengthen the CEL's monitoring capabilities. By providing training and equipment, the Agency will assist Qatar to develop the necessary monitoring capabilities to ensure the availability of reliable data on radioactivity concentrations in the event of a radiological emergency.

Qatar has also been participating in several country and Regional West Asia TC projects in nuclear safety in such areas as establishing an early warning network for nuclear accidents and radiological emergencies, strengthening the national framework for control of radiation sources and

occupational exposure, physical protection of nuclear materials, and development of a sustainable radiation and waste safety infrastructure.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Argonne National Laboratory

Qatar has been participating in a Regional West Asia TC project aimed at integrating nuclear medicine into the national healthcare system. This project is assessing the role of nuclear medicine in the region as well as the current needs of participating countries. This will help the Agency determine the types of projects necessary for expanding the role of nuclear medicine applications.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Qatari counterparts work to build the capacity of local

leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- In 2005, the U.S. accepted a Qatari fellow who will train in the field of radiation protection at the Oak Ridge Institute for Science and Education in Oak Ridge, Tennessee.
- In 2003, a U.S. expert provided services in Qatar in safety standards, regulations and procedures.

Qatar is encouraged to apply for IAEA fellowships and to participate in IAEA training courses held in the United States. For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Qatar have occurred on a direct, bilateral basis:

OFFICIAL VISITS

Since 1992, 13 U.S. officials have visited Qatar.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Qatar since 2002. Such exchanges have provided assistance in a variety of technical areas.

THE UNITED STATES AND THE REPUBLIC OF KOREA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with the Republic of Korea in support of these efforts, both bilaterally and through the IAEA.



AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: Argonne National Laboratory

The IAEA has been implementing a TC project in the Republic of Korea to develop new high-yield varieties of major food crops and to improve the plant nutrition management system to reduce the negative affects of chemical fertilizers on the environment. By using nuclear techniques to develop high-yield crops, it is estimated that the use of chemical fertilizers will be reduced by 40%. This will have a positive economic and environmental impact. Farmers will be able to save money by using less fertilizer, and the level of environmental contamination from chemical fertilizers will be reduced.

Agriculture Fellowships and Training in the U.S.

Since 1977, 106 Korean Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

INDUSTRY AND ENVIRONMENT

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



Credit: SiemensAG

The rapid growth of industry in the Republic of Korea has led to an increase in the pollution of water channels and reserves. To address this issue, the IAEA has been implementing a TC project in the Republic of Korea to establish a pilot plant for the treatment of wastewater and polluted water by using an electron beam machine. In this process, electron beams are used to destroy and decompose toxic materials and bacteria. With the help of Agency technical assistance, a pilot plant is being established to treat wastewater from the **Taegu Dye Industry Complex (IDIC.)** The pilot plant will not only help reduce the toxic discharge from the IDIC, but it will also be the first industrial scale use of this technology. This could lead to other commercial-scale uses of electron beam technology for wastewater treatment and will have a positive environmental impact.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



The IAEA helps countries to safely manage sealed radioactive sources (Credit: Kirstie Hansen/IAEA)

The Republic of Korea has been participating in several country and Regional Asia and the Pacific TC projects in nuclear safety. These projects have focused on safety in nuclear power plants, radiological emergency response, radiation protection, nuclear waste management, and radioactive waste disposal.

HUMAN RESOURCE DEVELOPMENT

Past exchanges and training missions between the U.S. and Korean counterparts helped to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1977, **160 Koreans** have participated in **86 training courses** hosted by the U.S.
- From 1979-2003, the U.S. has accepted **288 Fellows** and **10 Scientific Visitors** from the Republic of Korea. **Of these Fellows, 96 were fully funded by the U.S.**
- Since 1976, **264 U.S. experts** provided services in the Republic of Korea in many areas, including power reactors, safety of reactors and nuclear materials, quality assurance, radiometry and dosimetry, animal production, plant breeding and genetics, soil science, and agricultural biochemistry.

Korean Fellows, Scientific Visitors and course participants trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Nuclear Engineering and Technology** – Argonne National Laboratory

- **Safety in Nuclear Energy** – Sandia National Laboratory
- **Plant Breeding and Genetics** – U.S. Department of Agriculture
- **Agricultural Biochemistry** – University of California, Berkeley



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and the Republic of Korea have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958 211 Korean students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 300 Koreans received Ph.D.'s in the field of physics.

Korean Nuclear Physicians Certified in U.S.

Since 1972, 57 Korean Physicians obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

OFFICIAL VISITS

For the past 25 years, over 100 Koreans have either visited or been assigned to U.S. Government facilities, and over 50 U.S. officials have visited the Republic of Korea.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and the Republic of Korea since 1971. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND THE REPUBLIC OF MOLDOVA



SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with the Republic of Moldova in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment



Credit: Massoud Samiei/IAEA

have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The IAEA is implementing a TC project in the Republic of Moldova to upgrade the efficiency of the brachytherapy services at the **Oncological Institute of the Republic of Moldova**. Brachytherapy is used to treat malignant tumors. In this procedure, the radioactive source is placed in or near the tumor itself. This allows for the maximum dose of radiation to the tumor and minimizes the amount of damage to healthy tissue. Through expert services, training and the provision of a high dose rate brachytherapy unit, the Republic of Moldova is updating its brachytherapy services. Cancer patients that require brachytherapy will now be able to receive safe, cost-effective treatment that meets international standards.

ISOTOPE HYDROLOGY



Credit: Rodolfo Quevenco/IAEA

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.

The **Moldovan Artesian Basin** is the largest water resource in the country. The water from this region is important for human consumption, agriculture, irrigation and industry. The IAEA is implementing a TC project in the Republic of Moldova that uses isotope techniques to collect data on the groundwater sources in this system. This information will help the country develop a management strategy to ensure the sustainability of the Moldovan Artesian Basin.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container (Credit: IAEA)

The Republic of Moldova has been participating in several country and Regional Europe TC projects in such areas as radiation protection, preparedness and response for nuclear emergencies, radiation and waste safety, regaining control of "orphan sources," and upgrading the radiation protection infrastructure.

HUMAN RESOURCE DEVELOPMENT

The U.S. supports exchanges and training missions with several countries to build the capacity of local leaders by providing hands-on experience in handling more sophisticated scientific and technological tools. Every year, fellows, scientific visitors and training course participants from around the world receive training at American universities and institutes in several fields including entomology, plant breeding and genetics, animal diseases, groundwater hydrology, nutritional and health-related environmental studies, nuclear medicine and radiotherapy.

The Republic of Moldova is encouraged to apply for IAEA fellowships and to participate in IAEA training courses held in the United States.

For more information, please visit Argonne National Laboratory's International Programs website:

<https://international.dep.anl.gov/>

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the Republic of Moldova has cooperated with the U.S. on a direct, bilateral basis:

OFFICIAL VISITS

Since 1992, four Moldovans have either visited or been assigned to U.S. Government facilities, and U.S. officials have visited the Republic of Moldova.

THE UNITED STATES AND ROMANIA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Romania in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



The IAEA recently completed a TC project in Romania that worked with local counterparts to improve grape crop productivity using nuclear plant breeding and genetic techniques. Through this project, the IAEA and the **Valea Calugaresca Institute for Viticulture and Enology** teamed together to develop disease resistant vines and better quality grapes. The project contributed to increased grape productivity and reduced investment costs in wine plantations.

Agriculture Fellowships and Training in the U.S.

- *Since 1978, 14 Romanian fellows and scientific visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1990, Romanian counterparts have participated in entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

One of such projects currently underway is establishing a national quality assurance (QA) system for radiotherapy treatment. This project aims to

increase the accuracy of cancer treatment, thus reducing unnecessary exposure of patients and personnel. The reduced risk of errors in dose delivery will also lead to an increase in cure and remission rate, thus improving the quality of life of cancer patients.

Romanian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972, 13 Romanian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Romanian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1978, approximately 116 Romanians participated in 69 training courses hosted by the U.S.*
- *From 1959-2002, the U.S. accepted 52 fellows and 186 scientific visitors from Romania, 15 of which were fully funded by the U.S.*
- *For the past 10 years, U.S. experts made over 54 exchange missions to Romania to assist in the implementation of IAEA Technical Cooperation projects.*



IAEA/ANL Interregional Training Course on:
Emerging Nuclear Safety Issues for Decision Making

(Source: Argonne National Laboratory)

Romanian fellows, scientific visitors, and course participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Safety* – Argonne National Laboratory
- *Nuclear Medicine* – University of Washington
- *Entomology* – U.S. Dept. of Agriculture
- *Radiation Protection* – U.S. Nuclear Regulatory Commission
- *Agricultural Biochemistry* – U.S. Department of Agriculture

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Romania have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1974, 22 Romanian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 20 Romanians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 10 years, over 166 Romanians have either visited or been assigned to U.S. Government facilities, and over 43 U.S. officials have visited Romania.

SISTER LAB AGREEMENT

In 1999, the *Romanian Institute of Nuclear Energy (ICN)* and the U.S. Department of Energy's *Los Alamos National Laboratory (LANL)* entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and ICN counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*

The U.S. also recently pledged over USD 3.5 million through the IAEA to assist Romania in the conversion of its **TRIGA 14-MW** reactor from high-enriched uranium (HEU) to low-enriched uranium (LEU). This arrangement will result in extensive collaboration between the U.S. and Romanian counterparts as well as provide for the continued safe operation of this reactor.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Romania since 1971. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

Other exchanges include certified reference materials for calibration of a full spectrum of nuclear equipment, such as assuring the appropriate radiation dosage in nuclear medicine techniques.

THE UNITED STATES AND SAUDI ARABIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Saudi Arabia in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

Saudi Arabia participated in two Regional West Asia TC projects that the IAEA completed in the area of health. The first project used radioimmunoassay methods to screen for neonatal hyperthyroidism, a serious condition that, if detected early, is treatable. The second project aimed to improve the maintenance and quality control of nuclear medicine equipment.

Saudi Arabian Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1984, four Saudi Arabian physicians obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

INDUSTRY AND ENVIRONMENT

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



Credit: Siemens AG

Saudi Arabia uses high sulphur content oil combustion to produce electricity and technological steam, a process that produces a large amount of

air pollution. To address this problem, the IAEA is implementing a TC project in Saudi Arabia to study the feasibility of an electron beam flue gas treatment plant. This technology has been successfully used to remove sulphur dioxide and nitrogen dioxide from flue gasses produced by coal-fired boilers. The feasibility study would investigate whether it could be applied to Saudi Arabia's oil-fired boilers.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container (Credit: IAEA)

Saudi Arabia has been participating in several country and Regional West Asia TC projects in such areas as improving radiological protection of patients, national regulatory control and upgrading the radiation and waste safety infrastructure.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Saudi Arabian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1987, approximately **13 Saudi Arabians** participated in **10 training courses** hosted by the U.S.
- From 1978-2004, the U.S. accepted **14 Fellows** and **8 Scientific Visitors** from Saudi Arabia. **Of these Fellows, 5 were fully funded by the U.S.**
- Since 1983, **over 20 U.S. experts** provided services in Saudi Arabia in nuclear physics, agriculture, medicine, industry and hydrology, nuclear materials, safety in nuclear energy and general atomic energy development.

Agriculture Fellowships and Training in the U.S.

Since 1992, 9 Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agricultural biochemistry, entomology, and food preservation.

Saudi Arabian Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Research Reactors** – University of Illinois
- **Radiation Protection** – Argonne National Laboratory
- **Sterile Insect Technique** – University of Florida
- **Radiopharmaceuticals** – Massachusetts General Hospital



(Credit: Argonne National Laboratory)

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Saudi Arabia have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1974, 24 Saudi Arabian students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 4 Saudi Arabians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 50 Saudi Arabians have either visited or been assigned to U.S. Government facilities, and approximately 45 U.S. officials have visited Saudi Arabia.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Saudi Arabia since 1980. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND SENEGAL

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Senegal in support of these efforts, both bilaterally and through the IAEA.



AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: IAEA

Senegal relies heavily on the export of groundnuts, fish and fish products. In order to meet international sanitary and phytosanitary standards, Senegal has been working to improve its quality assurance and quality control systems.

Through an IAEA TC project, the Agency has been helping Senegal strengthen its technical capability for monitoring pesticide residues, mycotoxin, toxic metals and other contaminants in food. This will help increase exports and minimize health risks from contaminated food.

Agriculture Fellowships and Training in the U.S.

Since 1965, 12 Senegalese Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, animal disease, soil science, and plant breeding and genetics.

NUTRITION

Good nutrition is important for ensuring good health and is a contributing factor in social and economic development. Isotope techniques are a valuable tool in the global fight against hunger. They provide important information on micronutrient deficiencies. This information, in turn, can help determine the nature of nutrition problems, monitor the effectiveness of current nutrition programs and help guide the food industry in processing foods with optimal nutritional value.

In 1994, the Government of Senegal set up the **National Commission to Alleviate Nutrition** and launched the "Community Nutrition Project" to address the rising rate of malnutrition. In support of these efforts, the IAEA has been implementing a TC project to evaluate Senegal's food supplementation strategy. Isotope techniques are used to measure the impact of *néré* pulp fortified in iron, zinc, copper, vitamin A, and folic acid. The information will help Senegal determine the effectiveness of its nutrition program.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good

health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Petr Pavlicek/IAEA

Almost one million Senegalese suffer from Malaria each year, making it a national health priority. To address this issue, Senegal has implemented the **National Anti-Malaria Programme (PNLP)**. The IAEA is assisting these efforts through a TC project to evaluate

anti-malaria drugs. Molecular and radioisotope techniques are being used to monitor drug resistance. This data will help program managers develop effective treatment routines.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing



Credit: R. Fajdutti/UN FAO

information on sources, movement, and quantity of water in a variety of environments.

Through an IAEA TC project, the Agency is helping Senegal develop the local capability to use isotope techniques in managing groundwater resources. Isotope methods are being used to analyze the deep Maestrichtian aquifer near **Dakar**. Information on the recharge rate, flow and origin of salinity will help the government develop a water management plan for Senegal's groundwater resources. The IAEA's efforts in this project support the World Bank's Water Resource Program in Senegal.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Senegalese counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1983, **5 Senegalese** have participated in **2 training courses** hosted by the U.S.
- From 1965-2004, the U.S. has accepted **12 Fellows** and **2 Scientific Visitors** from Senegal. **Of these Fellows, 5 were fully funded by the U.S.**
- Since 1994, **6 U.S. experts** provided services in Senegal in agriculture, animal diseases, soil science, and groundwater hydrology.

Senegalese Fellows, Scientific Visitors and course participants have trained alongside U.S. counterparts at the following institutions:

- **Animal Diseases** – University of California
- **Soil Science** – University of Tennessee
- **Agricultural Biochemistry** – U.S. Food and Drug Administration
- **Power Reactors** – Argonne National Laboratory



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Senegal have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 15 years, 3 Senegalese have either visited or been assigned to U.S. Government facilities, and 2 U.S. officials have visited Senegal.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Exchanges of computer codes and related assistance have occurred between the U.S. and Senegal since 2001. Such exchanges have provided assistance in a variety of technical areas.

THE UNITED STATES AND SERBIA AND MONTENEGRO THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Serbia and Montenegro in support of these efforts through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



Serbia and Montenegro is currently participating in two regional Europe TC projects. One of them is to increase water-use efficiency, improve crop production, and reduce detriment to the environment through fertigation in conjunction with nuclear techniques. The other is to improve control of the Brucellosis disease in sheep and goats and to implement methods for the certification of milk and milk products as safe for human consumption using nuclear techniques that have proven successful in this area.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Vadim Mouchkin/IAEA)

Four Serbia and Montenegro TC projects are currently supported by the funds amounted to \$2.1 M from Nuclear Threat Initiative (NTI) in the areas of radioactive waste management technologies, and safety of RA research reactor at **Vinca Institute**. The U.S. is also supporting two national TC projects. One project is to stabilize and prepare spent fuel from **Vinca RA research reactor** for shipment abroad or long-term storage in a facility built in the country. The other is to complete characterization of and prepare detailed decommissioning plans for the **6.5-MW heavy water research reactor RA facility at Vinca Institute**. In the second phase, the project will focus on removal of contaminated structures and their transport into a storage facility, yet to be designed and built, on the site or elsewhere in the country.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Serbian and Montenegrin counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.



(Source: Turker Kurttas/IAEA)

Serbia and Montenegro is currently participating in three regional Europe TC projects in the areas of human resource development in various nuclear technologies, and capacity building for detection and response to illicit trafficking of radioactive materials.

For the project in illicit trafficking, the results of the project will enable Member States (MS) to create effective national systems for detection and response to illicit trafficking of radioactive materials. Each MS will conduct an exercise to test national coordination in case of an illicit trafficking incident, and prepare a country-specific handbook detailing the national response mechanism.



(Source: Argonne National Laboratory)

THE UNITED STATES AND SIERRA LEONE

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Sierra Leone in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Seibersdorf Plant Breeding Unit. The use of nuclear techniques in plant breeding and genetics can help improve crop yield. (Credit: Dean Calma/IAEA)

Rice is the main staple crop in Sierra Leone. However, pests, diseases, low soil fertility, and expensive fertilizers have led to a decline in domestic rice production. Currently, Sierra Leone only produces enough rice to meet 50% of the country's needs. The IAEA is implementing a

TC project in Sierra Leone to introduce high-yielding rice varieties. Mutation techniques are being used to develop varieties of rice with increased yield potential and tolerance to various environmental stresses. This will help Sierra Leone increase its rice production, which will help contribute to food security and economic development.

Agriculture Fellowships and Training in the U.S.

In 1994, a Sierra Leonean participated in an Interregional Training Course at the University of Florida on Use of Radiation and Isotopes in Insect Control and Entomology.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: Argonne National Laboratory

The IAEA has been implementing a TC project in Sierra Leone to improve water management of the **Inland Valley Swamp**. Isotope techniques are being used to study water flow, retention, and soil moisture. This data will help Sierra Leone improve its water management practices and expand the agricultural potential and rice production in this region.

NUTRITION

Good nutrition is important for ensuring good health and is a contributing factor in social and economic development. Isotope techniques are a valuable tool in the global fight against hunger. They provide important information on micronutrient deficiencies. This information, in turn, can help determine the nature of nutrition problems, monitor the effectiveness of current nutrition programs and help guide the food industry in processing foods with optimal nutritional value.

The IAEA is helping Sierra Leone combat malnutrition through a TC project in the area of human health. Nuclear techniques are being used to detect iron deficiencies in children under the age of five and women of childbearing age. The information gathered can help Sierra Leone determine the efficacy of its iron fortification efforts. Sierra Leone will also acquire the tools and skills necessary to tackle other micronutrient deficiencies.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Sierra Leonean counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1994, 5 Sierra Leoneans have participated in 5 training courses hosted by the U.S.
- From 1973-2004, the U.S. has accepted 5 Fellows from Sierra Leone. Of these Fellows, 2 were fully funded by the U.S.

Sierra Leonean Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Plant Breeding and Genetics** – U.S. Department of Agriculture
- **Radiation Protection** – Argonne National Laboratory



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Sierra Leone have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

A Sierra Leonean student has received a Ph.D. from a U.S. university in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 20 Sierra Leoneans have either visited or been assigned to U.S. Government facilities, and several U.S. officials have visited Sierra Leone.



THE UNITED STATES AND SINGAPORE

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Singapore in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Petr Pavlicek/IAEA

Singapore is participating in two Regional Asia and the Pacific TC projects in the area of human health. The first project seeks to improve the radiotherapy programs in participating member states. The Agency is assisting with improving brachytherapy treatment, training radiotherapy technologists and developing regional capacity for radiotherapy equipment maintenance and repairs. The expected result is improved treatment for patients with cancer of the cervix, head and neck, breast, and esophagus.

The second project aims to prevent osteoporosis and to promote healthy bone mass among the population. In this project, nuclear and isotopic techniques are being used to test bone density, monitor the effectiveness of treatments, predict risk for future bone fractures, and assess the effectiveness of diet-based treatments.

Singaporean Nuclear Physicians Certified in U.S.

In addition to support for the above projects, a Singaporean Physician obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container. (Credit: IAEA)

Singapore has been participating in several IAEA Interregional and Regional Asia and the Pacific TC projects in radiation protection, and radiation and waste safety.

INDUSTRY AND ENVIRONMENT



Credit: Siemens AG

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.

Singapore is participating in a Regional Asia and the Pacific TC project to improve information on urban air quality management. This project uses nuclear analytical techniques to assess the level of pollutants, determine their source and evaluate transboundary movement. This detailed information will enable Singapore to analyze its air pollution problems and implement an effective air quality management program.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Singaporean counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1979, **5 Singaporeans** have participated in **4 training courses** hosted by the U.S.
- From 1973-2004, the U.S. has accepted **7 Fellows** and **3 Scientific Visitors** from Singapore. **Of these Fellows, 5 were fully funded by the U.S.**
- Since 1980, **13 U.S. experts** provided services in Singapore in medical physics, radiometry and dosimetry, surface-water hydrology, nutritional and health-related environmental studies, and production of isotopes.



Credit: Argonne National Laboratory

Singaporean Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Radiation Protection** – Argonne National Laboratory
- **Medical Physics** – University of Texas Health Science Center
- **Nuclear Medicine** – Brigham Women's Hospital, Boston

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Singapore have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Four Singaporean students have received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 13 Singaporeans received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 20 years, over 40 Singaporeans have either visited or been assigned to U.S. Government facilities, and over 90 U.S. officials have visited Singapore.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Singapore since 1989. Such exchanges have provided assistance in a variety of technical areas.

THE UNITED STATES AND SLOVAKIA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Slovakia in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



(Source: David Kinley/IAEA)

The IAEA is currently supporting a Technical Cooperation project in Slovakia to strengthen the managerial and technical competency of the core counterpart team at the **Forest Research Institute** in order to build and operate, as a joint venture with the private sector, a mass-rearing facility for sterile insects where several insect species can be produced efficiently and cost effectively.

Agriculture Fellowships in the U.S.

In 2000, a scientific visitor from Slovakia visited an USDA mass-rearing facility in Phoenix.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

Several nuclear medicine-related regional Europe TC projects have been completed recently to increase the medical physics knowledge for science graduates working in radiology and radiotherapy and to establish a training program that would meet current and future needs in medical radiation physics. In addition, the infrastructure and facilities for nuclear medicine have been modernized, new clinical techniques have been introduced and radiotherapy for the treatment of cancer has been upgraded. A current TC project on upgrading tissue banking through radiation sterilization in Slovakia is ongoing.

Slovak Nuclear Physicians Certified in the United States

In addition to support for the above projects, since 1990, one Slovak physician obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

The estimated 1,000-1,500 ill or injured people will benefit annually from treatment by tissue grafting. The project will have a major impact on health care.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Vadim Mouchkin/IAEA)

The U.S. is currently supporting several regional Europe TC projects in such areas as strengthening of regional preparedness and response of nuclear emergencies, physical protection and security of nuclear materials, strengthening management of operational safety at nuclear power plants (NPPs) and utility organization and strengthening safety assessment capabilities of NPPs.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Slovak counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1981, approximately 84 Slovaks participated in 44 training courses hosted by the U.S.*
- *From 1993-2003, the U.S. accepted 22 Fellows and 11 Scientific Visitors from Slovakia, 14 of which were fully funded by the U.S.*

- *Since 1993, over 30 U.S. experts provided services in Slovakia in nuclear chemistry, agriculture, safety in nuclear energy and general atomic energy development.*

Slovak Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Reactor Safety** – U.S. Nuclear Regulatory Commission
- **Physical Protection** – Sandia National Laboratory
- **Sterile Insect Technique** – University of Florida
- **Nuclear Safety** – Argonne National Laboratory



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Slovakia have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 20 years, over 25 Slovaks have either visited or been assigned to U.S. Government facilities, and more than 50 U.S. officials have visited Slovakia.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Slovakia since 1994. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND SLOVENIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Slovenia in support of these efforts, both bilaterally and through the IAEA.



HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: IAEA

The IAEA has been implementing a TC project in Slovenia to establish initial values for guidance levels for diagnostic radiological procedures. Through this project, national guidance levels will be established, and it will be possible to identify installations where protocols, techniques and equipment are less than optimal. This will help ensure the lowest possible dose while, at the same time, ensuring accurate, optimal radiological procedures.

Slovenia has also been taking part in two Regional Europe TC projects in the area of human health. One project focuses on upgrading nuclear medicine practices to meet international standards. The second project is working to establish quality assurance and quality control programs. Both projects will ensure that patients receive safe, high quality treatment.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: Argonne National Laboratory

In many countries, irrigation systems are used to distribute fertilizers and nutrients to the soil. This process is known as fertigation and is considered a way to use fertilizers more efficiently. Slovenia has been participating in a Regional Europe TC project on the use of nuclear techniques together with fertigation to increase crop production and water-use efficiency. Nuclear techniques provide important information on irrigational management and fertilizer recovery by the crops. This will ensure proper management of soil, water, and nutrients.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



The IAEA helps countries to safely manage sealed radioactive sources (Credit: Kirstie Hansen/IAEA)

Slovenia has been participating in several country and Regional Europe TC projects in nuclear safety in the following areas: safety standards, regulations and procedures; radiation protection; safety of reactors and nuclear materials; radioactive waste disposal; environmental remediation; regulatory infrastructure for nuclear and radiation safety; and engineering safety.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Slovenian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1981, **62 Slovenes** have participated in **41 training courses** hosted by the U.S.
- From 1996-2004, the U.S. has accepted **6 Fellows** and **3 Scientific Visitors** from Slovenia. **Of these Fellows, 4 were fully funded by the U.S.**
- Since 1993, **80 U.S. experts** provided services in Slovenia in many areas including safety of reactors and nuclear materials, safety evaluation, power reactors, and quality assurance.

Slovenian Fellows, Scientific Visitors and course participants have trained alongside U.S. counterparts at the following institutions:

- **Safety of Reactors and Nuclear Materials** – Argonne National Laboratory
- **Safety in Nuclear Energy** – Sandia National Laboratory
- **Radiation Protection** – Oakridge National Laboratory
- **Radioactive Waste Management** – Lawrence Berkeley National Laboratory



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Slovenia have occurred on a direct, bilateral basis:

OFFICIAL VISITS

For the past 12 years, over 28 Slovenes have either visited or been assigned to U.S. Government facilities, and over 23 U.S. officials have visited Slovenia.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Slovenia since 1978. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND SOUTH AFRICA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with South Africa in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Credit: IAEA

The production and export of fruit in the Western and Northern Cape is important to the region. The use of pesticides to control fruit pests in this region has been limited by legal restrictions, environmental issues and pest resistance.

The IAEA has been implementing a TC project in West Africa to develop and expand to use of the sterile insect technique to control fruit pests such as the Medfly, Codling Moth, False Codling Moth, and Natal Fruit Fly. This project will have a positive economic and environmental impact on the fruit industry by allowing for increased fruit exports as well as healthier fruit and environmental conditions due to less pesticide use.

Agriculture Fellowships and Training in the U.S.

Since 1959, seventeen South African Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiei/IAEA

The emergence of drug resistant (DR) and multi-drug resistant (MDR) strains of tuberculosis (TB) in South Africa pose serious challenges to the control of TB in the country. The IAEA is currently implementing a TC project in South Africa to use isotopic molecular techniques to rapidly detect DR and MDR strains of TB. This information is essential for the diagnosis and treatment of TB and will contribute to the success of South Africa's national TB control programs.

South African Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1972 twenty-three South African Physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

NUTRITION

Good nutrition is important for ensuring good health and is a contributing factor to social and economic development. Yet, many people, particularly in developing countries, suffer from malnutrition. Isotope techniques are a valuable tool in the global fight against hunger. They provide important information on micronutrient deficiencies. This information, in turn, can help determine the nature of nutrition problems, monitor the effectiveness of current nutrition programs and help guide the food industry in processing foods with optimal nutritional value.

The IAEA has been implementing a TC project in South Africa to address iron deficiency anemia in women and children. The goal of this project is to evaluate the bio-availability of micronutrients in fortified products in order to determine the efficacy of current nutrition programs. This information will assist South Africa in fighting malnutrition.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and South African counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1979, approximately **43 South Africans** have participated in **30 training courses** hosted by the U.S.
- Since 1959, the U.S. has accepted **25 Fellows** and **14 Scientific Visitors** from South Africa. Of these Fellows, **15 were fully funded by the U.S.**

South African Fellows and Scientific Visitors have trained along side U.S. counterparts at various U.S. institutions in a variety of technical areas, including:

- **Radiation Protection**—Brookhaven National Laboratory
- **Animal Diseases**—U.S. Department of Agriculture
- **Nuclear Medicine**—Stanford University
- **Power Reactors**—Massachusetts Institute of Technology
- **Safety Evaluation**—U.S. Nuclear Regulatory Commission

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and South Africa have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, four South African students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional ten South Africans received Ph.D.'s in the field of physics.



Credit: Argonne National Laboratory

OFFICIAL VISITS

For the past 15 years, over 245 South Africans have either visited or been assigned to U.S. Government facilities and over 70 U.S. officials have visited South Africa.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and South Africa since 1975. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

Additionally, the U.S. Nuclear Regulatory Commission (NRC) currently maintains two technical information exchange and cooperation arrangements with South African counterparts. In 1994, NRC signed a bilateral agreement with the **Council for Nuclear Safety** and in 1999 a second agreement was signed with the **Department of Minerals and Energy**. Both arrangements remain active today.

THE UNITED STATES AND SRI LANKA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Sri Lanka in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



The poultry industry in Sri Lanka, which provides chicken meat and eggs for local demand, has developed tremendously in the past 20 years. However, the increase of breeder farms and commercial chick imports has brought a number of poultry diseases into the country. In the mid 1990's the U.S. began supporting an IAEA TC project that worked with the **Sri Lankan Department of Animal Production and Health (DAPH)** to establish a laboratory to diagnose and control poultry diseases using nuclear and related techniques. This project also trained field veterinarians and farmers in poultry disease prevention and vaccination. *Nuclear technologies improved the diagnosis and control of poultry diseases, thus increasing poultry production and the income of local farmers.* These techniques have also benefited other areas of the livestock and agriculture industries.

Agriculture Fellowships and Training in the U.S.

- *Since 1977, 13 Sri Lankan Fellows and four Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1981, Sri Lankan counterparts have participated in four entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek - IAEA)

The IAEA and the Government of Sri Lanka recently completed an IAEA TC project that established a general human tissue bank and created a national network that will make low cost tissue grafts more widely available.

As a result of this project, there will be increased availability of tissue grafts to victims of traumatic accidents, disease and congenital defects. The very low-income portion of the population in Sri Lanka, which previously had almost no access to such treatment, will benefit most. This project will also allow Sri Lanka to become a major supplier of a variety of tissue graft material to Southeast Asia and other parts of the world.

Sri Lankan Nuclear Physicians Certified in the United States

In addition to support for the above projects, since 1975, five Sri Lankan physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

INDUSTRY

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

One of such projects, currently underway, is using nuclear techniques to investigate dam safety and leakages. Initial reviews revealed that many dams in Sri Lanka are subject to serious leakage. This has significantly reduced hydropower generation and irrigation of domestic and industrial water supplies in the country. *This project will lead to cost-effective repair and modifications of high-risk dams and will ensure sustainable power generation, agricultural irrigation, and water supply. It will also improve the social and economic development of the country.*

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Sri Lankan counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1981, approximately 25 Sri Lankans participated in 19 training courses hosted by the U.S.*
- *Since 1977, the U.S. accepted 53 Fellows and six Scientific Visitors from Sri Lanka, 29 of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Sri Lankan Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Safety* – Argonne National Laboratory
- *Food Preservation* – Texas A&M University
- *Nuclear Physics* – Oak Ridge National Lab
- *Nuclear Medicine* – Harvard Medical School
- *Radiation Protection* – U. S. Department of Agriculture



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Sri Lanka have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, 11 Sri Lankan students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 17 Sri Lankans received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 139 Sri Lankans have either visited or been assigned to U.S. Government facilities, and numerous U.S. officials have visited Sri Lanka.

EXPERT MISSIONS

In the past 25 years, U.S. experts made over 22 exchange missions to Sri Lanka to assist in the implementation of IAEA Technical Cooperation projects.

THE UNITED STATES AND TAJIKISTAN

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Tajikistan in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiet/IAEA

The **Republican Clinical Centre of Oncology (RCCO)** in Tajikistan is the only radiotherapy center in the country. The equipment at the RCCO is obsolete and not in line with current radiation protection practices. The Agency has begun implementing a TC project in Tajikistan to upgrade the radiotherapy services at the RCCO. The project will focus on training in current techniques and treatment procedures and upgrading dosimetry and radiation protection services. This will allow more cancer patients to receive safe treatment. The Agency has also been implementing a TC project to upgrade the nuclear medicine services at the **Institute of Gastroenterology**.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- **Eradicating and controlling insects**
- **Increasing the yield, quality and disease resistance of crops**

- **Improving the quality of food and protection from spoilage and losses**
- **Promoting animal health and productivity**

Severe soil erosion in Tajikistan has led to a loss of land productivity and the degradation of water quality. To address this problem, the IAEA has begun implementing a TC project to assess soil erosion and sedimentation. This project will use nuclear techniques to determine erosion rates and the distribution of erosion/sedimentation problems. This information will help the Tajik Government take appropriate measures to deal with this problem.

NUCLEAR SAFETY

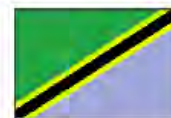
In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container (Credit: IAEA)

Tajikistan is currently participating in several Regional West Asia TC projects in such areas as national regulatory control and occupational radiation protection, radiation and waste safety, and control of "orphan sources."

THE UNITED STATES AND TANZANIA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Tanzania in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



(Laboratory for the rearing of sterilized tsetse flies. Source: David Kinley/IAEA)

In the mid-1990's, the U.S. contributed over \$1.1 million in funding to assist the IAEA and the U.N. Food and Agriculture Organization (FAO) carry out an animal disease control campaign using the sterile insect technique (SIT) on the island of **Zanzibar**. By 1997, the campaign successfully ridded the island of the deadly **tsetse fly**, carrier of the disease trypanosomiasis, commonly known as sleeping sickness. This disease, a leading cause of loss of human life in Africa, also attacks livestock, killing millions of such animals each year, and resulting in huge economic losses. *Since the successful eradication of the tsetse fly on Zanzibar Island, the production and marketing of milk and milk products has increased, thus improving the local economy and contributing to better nutrition.*

Agriculture Fellowships and Training in the U.S.

- *Since 1986, 12 Tanzanian fellows and scientific visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1992, Tanzanian counterparts have participated in four training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Vadim Mouchkin/IAEA)

One of such projects currently underway is working to improve the accuracy of radiotherapy planning and treatment at the

Ocean Road Cancer Institute (ORCI) in Dar es Salaam, the country's only hospital with cancer treatment capabilities. This project is expected to greatly improve the quality and effectiveness of treatment received by cancer patients.

Tanzanian Nuclear Physicians Certified in the United States

In addition to support for the above projects, since 1976, three Tanzanian physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: WSSD Brochure/U.S.AID, DOE & DOS)

The IAEA is currently carrying out a TC project in Tanzania that is using isotope hydrology techniques to identify unused groundwater resources. Currently, the country's main source of water for domestic and industrial uses is the **Ruvu River**, which supplies water for about 3,000,000 residents of **Dar es Salaam** and the neighboring towns of **Bagamoyo** and **Kibaha**. The current demand for water in these areas is estimated to be much higher than what is available from this water source. As a result, the IAEA is working with the local Government to tap the groundwater potential of the **Ruvu Basin**. *It is believed that eventual use of the Ruvu Basin will not only alleviate the water problems for the inhabitants of Dar es Salaam surrounding areas, but will also improve industrial output and food production.*

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Tanzanian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1981, approximately 26 Tanzanians participated in 21 training courses hosted by the U.S.*

- *From 1980-2002, the U.S. accepted 34 fellows and scientific visitors from Tanzania, 10 of which were fully funded by the U.S.*
- *In the past 25 years, U.S. experts made over 27 exchange missions to Tanzania to assist in the implementation of technical cooperation projects.*

TRAINING IN THE U.S.

Tanzanian fellows, scientific visitors, and course participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Isotope Hydrology* – Argonne National Laboratory
- *Medical Physics* – Harvard Medical School
- *Plant Breeding* – Washington State University
- *Processing Raw Materials* – U.S. Geological Survey



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Tanzania have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Tanzanian students have received Ph.D.'s from U.S. universities in the area of nuclear studies.

OFFICIAL VISITS

For the past 15 years, over 21 Tanzanians have either visited or been assigned to U.S. Government facilities, and several U.S. officials have visited Tanzania.

THE UNITED STATES AND THAILAND THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Thailand in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



Fruit flies are major insect pests for fruit production in Thailand, causing yield losses, degradation of quality, and leading to quarantine restrictions from major fruit importing countries. To facilitate improved fruit production, the IAEA initiated a TC project using the **sterile insect technique (SIT)** to control the fruit fly population in southwest Thailand. The project has already successfully controlled the Oriental fruit fly population in **Ratchaburi** province southwest of **Bangkok** and is now being expanded to **Pichit**. *The eradication of local fruit flies will not only increase the availability of healthy fruit crops for consumption, but will also contribute to improved economic conditions by allowing local farmers to produce crops that are acceptable for export purposes.* Utilizing SIT will also reduced the need for conventional insecticides, thus reducing negative effects on the environment.

Agriculture Fellowships and Training in the U.S.

- *Since 1959, 122 Thai Fellows and 41 Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Since 1986, Thai counterparts have participated in six entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek - IAEA)

The IAEA is currently working with the **Thai Ministry of Public Health** to expand the coverage of the national neonatal screening program for congenital hypothyroidism (CH).

CH is one of the major causes of mental retardation in children and is particularly common among Asian babies, but is treatable if diagnosed early in life. A neonatal screening program will contribute to early detection, diagnosis, and treatment of these children, which will improve the quality of life as well as prevent treatable mental retardation.

Thai Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1972, 11 Thai physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

One of such projects, currently underway, is using nuclear techniques to manage and protect the supply of fresh drinking water throughout the region. Initial studies revealed that arsenic pollution is a serious problem in Asia, particularly in Thailand. The IAEA is working with local counterparts to analyze groundwater resources and identify the source of the contamination, which will protect the country's supply of potable water.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Thai counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1976, approximately 89 Thais participated in 62 training courses hosted by the U.S.
- Since 1959, the U.S. accepted 353 Fellows and 65 Scientific Visitors from the Thailand, 197 of which were fully funded by the U.S.
- In the past 25 years, U.S. experts made over 97 exchange missions to Thailand to assist in the implementation of IAEA Technical Cooperation projects.

TRAINING IN THE U.S.

Thai Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- *Nuclear Safety* – Argonne National Laboratory
- *Food Safety* – Texas A&M University
- *Radiation Protection* – Brookhaven National Lab
- *Plant Breeding* – U. S. Department of Agriculture
- *Nuclear Medicine* – Centers for Disease Control



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Thailand have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1964, 18 Thai students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 4 Thais received Ph.D.'s in the field of physics.

SISTER LAB AGREEMENT

In 1993, the *Thai Office of Atomic Energy for Peace (OAEP)* and the *U.S. Department of Energy* entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and OAEP counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*

Current programs are focused on reactor safety and physics at the country's TRIGA reactor.

OFFICIAL VISITS

For the past 15 years, over 106 Thais have either visited or been assigned to U.S. Government facilities, and 107 U.S. officials have visited Thailand.

THE UNITED STATES AND TUNISIA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Tunisia in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Larval trays for mass production of fruit flies (Credit: Lindquist/IAEA)

The Mediterranean fruit fly (Medfly) is a destructive insect that has had a negative impact on Tunisia's citrus fruit production. The IAEA has been implementing two TC projects in Tunisia to establish the necessary infrastructure for and measure the effectiveness of the use of the sterile insect technique (SIT) for Medfly control and eradication. This will enable Tunisia to expand its citrus fruit production. By replacing insecticide-based control

methods with the SIT, Tunisia will be able to improve the quality of its fruit, which will lead to greater fruit exports.

Agriculture Fellowships and Training in the U.S.

Since 1967, 9 Tunisian Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, entomology and food preservation.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: Argonne National Laboratory

The IAEA has been implementing two TC projects in Tunisia to help the country cope with the growing pressure for water. Both projects use isotope hydrology techniques combined with conventional methods to investigate the

coastal aquifers in the **Cap Bon region**. These techniques will provide information on the conditions of the aquifers, such as salinity and recharge rate. This will help the government better monitor the encroachment of seawater and overexploitation in order to ensure sustainable freshwater supply for human consumption and agricultural use.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Teletherapy unit (Credit: Massoud Samiet/IAEA)

The Government of Tunisia has been working to strengthen cancer treatment capabilities in the country. As part of this program, the IAEA has been implementing a TC project in Tunisia to upgrade the teletherapy

and brachytherapy techniques at the **Tunis Salah Azaiz Institute (ISA)** and the **Sousse and Sfax Hospital Centers**. This will increase the number of cancer patients treated in the country.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Tunisian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1981, **33 Tunisians** have participated in **18 training courses** hosted by the U.S.
- From 1967-2004, the U.S. has accepted **3 Fellows** and **4 Scientific Visitors** from Tunisia. **Of these Fellows, all were fully funded by the U.S.**
- Since 1985, **14 U.S. experts** provided services in Tunisia in entomology, animal production and fisheries, plant breeding and genetics, and safety of reactors and nuclear materials.

Tunisian Fellows, Scientific Visitors and course participants have trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Food Preservation** – U.S. Department of Agriculture
- **Groundwater Hydrology** – Argonne National Laboratory
- **Safety in Nuclear Energy** – Sandia National Laboratory



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the U.S. has cooperated with Tunisia on a direct, bilateral basis:

OFFICIAL VISITS

Since 1986, over 60 Tunisians have either visited or been assigned to U.S. Government facilities, and U.S. officials have also visited Tunisia.

THE UNITED STATES AND TURKEY

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Turkey in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



A Technical Cooperation Project on food irradiation technology in Turkey is underway to assist the food industry in developing irradiation technology as a substitute for methyl bromide fumigation of dried fruits and nuts. The project is also conducting a feasibility study for the construction of an irradiation facility. The replacement of methyl bromide fumigation by irradiation will prevent serious economic detriment that would be caused by eventually unavailability of the chemical.

There are two agriculture-related regional Europe TC projects in which Turkey has participated. One of them is to increase water-use efficiency, improve crop production, and reduce detriment to the environment through fertigation in conjunction with nuclear techniques. The other is to improve control of the Brucellosis disease in sheep and goats and to implement methods for the certification of milk and milk products as safe for human consumption using nuclear techniques that have proven successful in this area.

Agriculture Fellowships in the U.S.

- *Since 1962, approximately 30 Fellows and Scientific Visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek/IAEA)

The IAEA is currently supporting a nuclear medicine-related Technical Cooperation project in Turkey that is improving the capacity of the **new Medical Physics Laboratory at Ankara University** and to provide more effective training to medical physicists. In addition, there are two regional projects that are on-going. One of them is to upgrade nuclear medicine practices to international standards in national hospitals in the field of diagnostics and therapy. The other project is to establish a working

Turkish Nuclear Physicians Certified in the United States

In addition to support for the above projects, since 1972, 26 Turkish physicians obtained certifications to practice nuclear medicine from the **American Board of Nuclear Medicine**.

quality assurance (QA) program to reach the level of Centres of Competence. This project will help in sustainable training to upgrade the skills of clinicians, medical physicists, and radiation technologists. In addition, the introduction of quality audit more widely in radiotherapy departments will help meet the demand for cancer treatment.

INDUSTRIAL APPLICATIONS

Through IAEA Technical Cooperation projects, developing countries are learning to use isotopes and radiation for process development and improvement, measurement and automation, and quality control.



(Source: Petr Pavlicek/IAEA)

The IAEA is currently supporting industry-related projects in Turkey to establish an advanced non-destructive testing (NDT) techniques laboratory at the **Çekmece Nuclear Research and Training Centre (CNRTC)** and to develop and produce polymeric hydrogels by ionizing radiation for medical applications such as wound dressing materials and controlled drug delivery systems.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Turkish counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1976, approximately 97 Turkish counterparts participated in 60 training courses hosted by the U.S.*
- *From 1959-2003, the U.S. accepted 212 Fellows and 17 Scientific Visitors from Turkey, 121 of which were fully funded by the U.S.*

Turkish Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Nuclear Medicine** – Johns Hopkins Medical Institute
- **Research Reactors** – Argonne National Laboratory
- **Physical Protection** – Sandia National Laboratory
- **Sterile Insect Technique** – University of Florida
- **Nutrition and Health** – Massachusetts Institute of Technology



**IAEA/ANL Interregional Training Course on:
Emerging Nuclear Safety Issues for Decision Making**

(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Turkey have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958, 71 Turkish students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 48 Turkish students received Ph.D.'s in the field of physics.

OFFICIAL VISITS

Since 1986, over 265 Turkish officials have either visited or been assigned to U.S. Government facilities and numerous U.S. officials have visited Turkey.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Turkey since 1996. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND UGANDA

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Uganda in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agricultural production. Such techniques have been used for:

- Eradicating and controlling insects
- Increasing the yield, quality and disease resistance of crops
- Improving the quality of food and protection from spoilage and losses
- Promoting animal health and productivity



Laboratory for the rearing of sterilized tsetse flies. (Credit: David Kinley/IAEA)

Agriculture plays an important role in the economic development of Uganda. The presence of certain species of the tsetse fly in the **Lake Victoria Basin** has hampered the development of agriculture and animal production in this region. Through an IAEA TC project, the Agency is assisting Uganda with using the Sterile Insect Technique (SIT) to create a tsetse-free zone in this area. The eradication of the tsetse fly from the Lake Victoria Basin

will open the area for agricultural development and will help contribute to the socio-economic development of Uganda. Uganda has also been participating in two interregional TC projects on using SIT to control insect pests.

Agriculture Fellowships and Training in the U.S.

Since 1982, 16 Ugandan Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, animal disease, entomology, and plant breeding and genetics.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Pupils draw water from a well at the Buligo Primary School in Uganda. (Credit: Levis Kavagi)

The IAEA is implementing a TC project in Uganda to help manage individual towns' water supplies in Southwestern Uganda. Isotope techniques are being used to provide information on the source, flow path, quantity, and recharge rate of water in deep boreholes, shallow wells, and springs. This information will help the government of Uganda develop a water management policy that will ensure a sustainable water supply for towns in this region.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good



Credit: Massoud Samiei/IAEA

health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The IAEA is implementing a TC project in Uganda to expand the radiotherapy services at the **Mulago Hospital in Kampala**. The Agency is providing training for a radiation oncologist, a medical physicist and a therapy radiographer. This will enable Uganda to treat more cancer patients.

The IAEA is also implementing a TC project to help Uganda evaluate its nutrition rehabilitation campaign for malnourished children. Through this project, isotope techniques are being used at the **Mwanamugimu Nutrition Unit** at Mulago Hospital to examine the impact of its food-based rehabilitation program. The information will help ensure that malnourished children receive more effective treatment.

Ugandan Nuclear Physicians Certified in U.S.

In addition to support for the above projects, in 1986 a Ugandan Physician obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Ugandan counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1982, **13 Ugandans** have participated in **11 training courses** hosted by the U.S.

- From 1982-2004, the U.S. has accepted **17 Fellows** from Uganda. **Of these Fellows, 3 were fully funded by the U.S.**
- Since 1992, **5 U.S. experts** provided services in Uganda in food preservation, groundwater hydrology, and animal production and fisheries.

Ugandan Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Sterile Insect Technique** – University of Florida
- **Radiation Protection** – Argonne National Laboratory
- **Plant Breeding and Genetics** – Texas A & M University
- **Radiotherapy** – Merle West Cancer Treatment Center, Oregon



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the U.S. has cooperated with Uganda on a direct, bilateral basis:

OFFICIAL VISITS

For the past 10 years, over 10 Ugandans have either visited or been assigned to U.S. Government facilities.

THE UNITED STATES AND UKRAINE

SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Ukraine in support of these efforts, both bilaterally and through the IAEA.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed



*Chernobyl nuclear power plant with sarcophagus. (Chernobyl, Ukraine)
Credit: Vadim Mouchkin/IAEA*

safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.

In 1999, the U.S., Japan and the UK assisted Ukraine with the creation of the **International Radio-Ecology Lab**

(IRL) to investigate the biological and environmental effects of radioactive contamination in the Chernobyl zone. With the help of over \$200,000 in U.S. extra-budgetary contributions, the IAEA recently completed a project to establish training facilities for radio-ecology at the IRL. This facility will be important in studying the ecosystem's response to



A woman takes her food to be checked for gamma-emitting radionuclides during the International Chernobyl Assessment Project. (Credit: Elisabeth Zeiler/IAEA)

radioactive contamination, planning steps to prevent the spread of contamination, and minimizing the consequences of future accidental releases.

Ukraine has also participated in several country and Regional Europe TC projects in nuclear safety in the following areas: nuclear and radiation safety and nuclear security; safety standards; radiation protection;

safety of reactors and nuclear materials; safety assessment of nuclear facilities; safety of environmental remediation; regulatory infrastructure for nuclear and

radiation safety; engineering safety; research reactor safety; and environmental exposure control.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good



Credit: Massoud Samiei/IAEA

health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.

The Agency is implementing a TC project in Ukraine to improve cancer treatment

through implementation of quality assurance (QA) programs. By providing equipment, expert services and training on treatment planning, the Agency is assisting Ukraine with establishing QA programs at the **Radiotherapy Department of the Grigoriev Institute for Medical Radiology in Kharkiv** and the **Clinical Dosimetry and Computed Planning Department of the Oncology Institute in Kiev**. These programs are helping to ensure the quality and safety of cancer treatment in Ukraine.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Ukrainian counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1993, **73 Ukrainians** have participated in **37 training courses** hosted by the U.S.
- From 1993-2004, the U.S. has accepted **30 Fellows** and **8 Scientific Visitors** from Ukraine. Of these Fellows, **12 were fully funded by the U.S.**

- Since 1991, **54 U.S. experts** provided services in Ukraine in nuclear safety, environmental protection, power reactors, radioactive waste management, and quality assurance.

Ukrainian Fellows and Scientific Visitors have trained alongside U.S. counterparts at the following institutions:

- **Environmental Protection** – Texas Technical University
- **Radiation Protection** – University of Washington
- **Safety of Reactors and Nuclear Material** – Argonne National Laboratory
- **Treatment and Disposal of Radioactive Waste** – Gilbert/Commonwealth, Inc.



Credit: Argonne National Laboratory

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Ukraine have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1991, a Ukrainian student received a Ph.D. from a U.S. university in the area of nuclear studies and an additional 47 Ukrainians received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 13 years, over 350 Ukrainians have either visited or been assigned to U.S. Government facilities, and over 300 U.S. officials have visited Ukraine.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Ukraine since 1994. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND UNITED ARAB EMIRATES SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with United Arab Emirates in support of these efforts, both bilaterally and through the IAEA.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



Credit: R. Faidutti/UN FAO

In the United Arab Emirates, the IAEA has been implementing a TC project to assess artificial groundwater recharge. This project uses isotope techniques to better understand the hydrological aspects of the reservoirs and aquifer systems in **Tawiya, Wurrayah, Ham, and Bih**. This information will assist the Emirati Ministry of Agriculture and Fisheries in determining the effectiveness of artificial groundwater recharge from water stored during the rainy season. The United Arab Emirates also participated in a similar TC Regional West Asia project on Isotope Applications for Improved Groundwater Use.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



Credit: Massoud Samiei/IAEA

The United Arab Emirates has been participating in a Regional West Asia TC project to assess the current situation of the use, quality and spectrum of nuclear medicine in West Asia. This information will then be used to develop a realistic and systematic plan for integrating nuclear medicine into the national healthcare systems of the participating countries.

Emirati Nuclear Physicians Certified in U.S.

In addition to support for the above projects, since 1999, one Emirati physician obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

NUCLEAR SAFETY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container. (Credit: IAEA)

The United Arab Emirates has been participating in several country and Regional West Asia TC projects in such areas as improving radiological protection of patients, national regulatory control and occupational radiation protection and upgrading the radiation and waste safety infrastructure.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Emirati counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1988, approximately **2 Emiratis** participated in **2 training courses** hosted by the U.S.
- Since 1994, more than three U.S. experts provided services in United Arab Emirates in safety in nuclear energy and medicine.

Emirati Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Radiation Protection** – Argonne National Laboratory
- **Sterile Insect Technique** – University of Florida

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and United Arab Emirates have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1997, 2 Emirati students received Ph.D.'s from U.S. universities in the field of physics.

OFFICIAL VISITS

For the past 15 years, more than 10 Emiratis have either visited or been assigned to U.S. Government facilities, and over 20 U.S. officials have visited United Arab Emirates.

COMPUTER CODE EXCHANGE AND TECHNICAL ASSISTANCE

Several exchanges of computer codes and related technical assistance have occurred between the U.S. and United Arab Emirates since 1990. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND URUGUAY



SUPPORT THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY

The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Uruguay in support of these efforts, both bilaterally and through the IAEA.

HUMAN HEALTH

Peaceful applications of nuclear technology contribute significantly to the establishment and maintenance of good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of diseases such as cancer and malaria.



The use of radiation technology in tissue banking provides sterilized bone, skin and other tissues that can help heal serious wounds and injuries.

For the past 25 years, Uruguay has had to rely on the National Bank of Organs and Tissues for reliable grafts of human tissue and organs for transplant. Uruguay has been participating in a Regional Latin America TC Project with the goal of ensuring a sufficient local supply of sterilized, high-quality tissue grafts.

Uruguay has also been taking part in a Regional Latin America TC project to implement quality assurance programs in radiotherapy centers by providing them with trained medical physicists and equipment.

Uruguayan Nuclear Physicians Certified in U.S.

In addition to support for the above projects, Uruguayan physicians have also obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

ISOTOPE HYDROLOGY



Credit: R. Faidutti/UN FAO

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources.

Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.

Uruguay has been participation in two Regional Latin America TC projects to optimize sustainable management of groundwater resources in the region. The first project seeks to use isotope techniques together with conventional techniques in order to develop and implement a sustainable groundwater management policy. The objective of the second project is to use isotope techniques in the management and preservation of the **Guarani Aquifer** through the Guarani Aquifer project supported by the World Bank/Global Environmental Facility.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



Inspectors investigate the safety of a fuel container (Credit: IAEA)

Uruguay is currently participating in several regional Latin America TC projects in such areas as strengthening of regional preparedness and response of nuclear emergencies, radiation protection, and radiation and transport safety.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Uruguayan counterparts work to build the capacity of local leaders, by providing hands-on experience in handling more sophisticated science and technological tools.

- Since 1981, approximately **21 Uruguayans** have participated in **14 training courses** hosted by the U.S.
- From 1962-2004, the U.S. has accepted **30 Fellows** and **16 Scientific Visitors** from Uruguay. Of these Fellowships, **13 were fully funded by the U.S.**

BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Uruguay have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1969, 2 Uruguayans received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional 3 Uruguayan students received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 25 years, over 16 Uruguayans have either visited or been assigned to U.S. Government facilities, and over 10 U.S. officials have made visits to Uruguay.

THE UNITED STATES AND UZBEKISTAN THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Uzbekistan in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



Uzbekistan's economy is heavily dependent on agriculture. The vast irrigation system for cotton monoculture, with its improper water management practices and fertilizer use over the years, has adversely affected the environment. The IAEA is currently working with the **Uzbek National Cotton Growing Research Institute (UNCRI)** to optimize the use of water and fertilizer for the major crops, cotton and winter wheat under different soil conditions. The results of the project will help reduce environmental damage and also contribute positively to the international efforts to restore the ecological balance in the Aral Sea region.

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: IAEA)

Uzbekistan is currently implementing three nuclear medicine-related TC projects. One project is to establish a single-photon emission computed tomography (SPECT) facility which would be the first SPECT facility in a large medical complex at the **National Centre of Surgery** in Uzbekistan. SPECT is recognized as the most informative and non-invasive method of investigation in many cardiac, neurological, and oncological disorders and conditions. The facility will provide the much needed support to the cardiologists, oncologists, and neurosurgeons at the centre and thus upgrade the quality of the national healthcare system.

Two other projects are related to the detection and management of cancer. Regional pathological diagnostic services will be established. The services will be provided based on radioimmunoassay (RIA) technologies using locally formulated kits.

Uzbek Nuclear Physicians Certified in the United States

In addition to support for the above projects, since 2002, one Uzbek physician obtained certification to practice nuclear medicine from the American Board of Nuclear Medicine.

SAFETY IN NUCLEAR ENERGY

In all areas of cooperation, the IAEA maintains a strong emphasis on nuclear safety. The Agency has developed safety standards covering such areas as nuclear power plants, radiation protection, radioactive waste management, and transportation safety.



(Source: Vadim Mouchkin/IAEA)

Uzbekistan is participating in several regional TC projects which the U.S. is currently supporting. The projects are in such areas as national regulatory control and occupational radiation protection programs, development of technical capabilities for sustainable radiation and waste safety infrastructure, safety review of research reactor facilities and legislative assistance for utilization of nuclear energy.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Uzbek counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *From 1996-2003, approximately 11 Uzbeks participated in 8 training courses hosted by the U.S.*
- *Since 1996, the U.S. accepted 8 Fellows from Uzbekistan.*

Uzbek Fellows and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Research Reactors** – University of Virginia

- **Radiation Protection** – Argonne National Laboratory
- **Environmental Research** – Argonne National Laboratory
- **Nuclear Fuel Management** – Argonne National Laboratory



(Source: Argonne National Laboratory)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Uzbekistan have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1997, one Uzbek student received a Ph.D. from an U.S. university in the area of nuclear study.

OFFICIAL VISITS

For the past 10 years, Uzbeks have either visited or been assigned to U.S. Government facilities, and several U.S. officials have visited Uzbekistan.

SISTER LAB AGREEMENT

In July 2002, the *Institute of Nuclear Physics, Uzbekistan Academy of Sciences (INP)* and the *U.S. Department of Energy* entered into an arrangement for technical exchange and cooperation in the area of peaceful uses of nuclear energy. This "sister lab" arrangement established a direct line of communication between U.S. nuclear specialists and INP counterparts, facilitating various collaborative projects including:

- *Exchange of scientific and technical information*
- *Short-term visits by expert teams or individuals*
- *Training of scientific and technical personnel through fellowships, seminars or courses*

The cooperation was done through Argonne National Laboratory. The focus was on an experiment at the Argonne Tandem Linac Accelerator System (ATLAS). In this experiment, the nuclear structure of excited states in ^{19}Ne was investigated using the magnetic spectrograph. This helped the visitors get accustomed with the equipment which would be used in Uzbekistan in the future.

THE UNITED STATES AND VENEZUELA THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Venezuela in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production. Such techniques have been used for:

- *Eradicating and controlling insects*
- *Increasing the yield, quality and disease resistance of crops*
- *Improving the quality of food and protection from spoilage and losses*
- *Promoting animal health and productivity*



The IAEA recently completed a TC project in Venezuela that used nuclear techniques to improve the quality of fruit and pepper crops. Plant breeding techniques were used to identify and cultivate **mango, passion fruit and black pepper** crops that are most resistant to disease and environmental constraints. As a result of this project, the amount of crops available for export is expected to rise, thus increasing the income of local farmers and contributing to an improved economy.

Agriculture Fellowships and Training in the U.S.

- *Since 1961, 32 Venezuelan fellows and scientific visitors have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Juanita Perez Vargas - IAEA)

The IAEA recently began a technical cooperation project in Venezuela that is upgrading the country's nuclear medicine facilities to improve the treatment, prevention, and early diagnosis of breast cancer. The goal of the project is to initiate a nationwide breast cancer-screening program that will lead to an increase in public awareness and early detection.

The improved diagnostic and treatment capabilities as a result of this information system is expected to result in reduced cancer mortality rates.

Venezuelan Nuclear Physicians Certified in the U.S.

In addition to support for the above projects, since 1973, three Venezuelan physicians obtained certifications to practice nuclear medicine from the American Board of Nuclear Medicine.

INDUSTRY

Nuclear techniques have important applications in almost every branch of industry. These techniques help cut costs, improve efficiency and safety, enhance quality control, and minimize the adverse impacts of industrial emissions on the environment.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

One of such projects currently underway is using nuclear techniques in the planning and construction phases of dams and reservoirs to ensure their reliability and safety. The project will begin with an analysis of the **Borde Seco III Dam**, which will serve as a model for analyzing dam safety and repair throughout the country. The project also aims to reduce dam leakages and optimize the generation of hydroelectric power.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Venezuelan counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1976, approximately 43 Venezuelans participated in 26 training courses hosted by the U.S.*
- *Since 1961, the U.S. accepted 43 fellows and 13 scientific visitors from Venezuela, 13 of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Venezuelan fellows, scientific visitors, and course participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Energy Planning** – Argonne National Laboratory
- **Radiotherapy** – Sloan Kettering Cancer Institute
- **Soil Science** – University of California Berkley
- **Agricultural Biochemistry** – U.S. Department of Agriculture



(Source: David Kinley -IAEA)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Venezuela have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1964, 10 Venezuelan students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional seven Venezuelans received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 290 Venezuelans have either visited or been assigned to U.S. Government facilities, and 90 U.S. officials have visited Venezuela.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Numerous exchanges of computer codes and related technical assistance have occurred between the U.S. and Venezuela since 1983. Such exchanges have provided technical assistance in the areas of radiation transport and safety.

THE UNITED STATES AND VIETNAM THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials and information for peaceful purposes and looks forward to continued cooperation with Vietnam in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



One of such projects, currently underway, is using nuclear techniques to improve the quality and resistance of the country's most important crops - rice, maize, and soybeans. Vietnam relies heavily on rice crops for both consumption and export purposes; in 1997 the country was the world's second largest rice exporter. However, the frequent occurrence of devastating floods and typhoons has hampered rice productivity, particularly in the very fertile **Mekong Delta**.

This project will allow farmers to grow new varieties of rice crops with higher yields and better quality, thus generating higher income. *Improved rice productivity will enhance food security in the country and will also strengthen Vietnam's competitiveness in the world market. It will also benefit local farmers, who will gain from the increased and better-quality rice yields.*

Agriculture Fellowships and Training in the U.S.

- *Since 1965, Vietnamese Fellows, Scientific Visitors, and Course Participants have trained in the U.S. in the areas of agriculture, health studies, animal disease, entomology, food preservation, soil science, and plant breeding and genetics.*
- *Vietnamese counterparts have also participated in entomology training courses held at the University of Florida on the use of sterile insect and related techniques for the area-wide management of insect pests.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



(Source: Petr Pavlicek - IAEA)

In 1998, the U.S. began supporting an IAEA TC project to improve Vietnam's nuclear medicine capabilities at **Tran Hung Dao General**

Hospital in Hanoi. The project is increasing the country's ability to apply nuclear medicine procedures to manage childhood diseases, cancer, coronary artery disease, and degenerative disorders. The project will also assist the Vietnamese government in establishing a network of nuclear medicine units throughout the country.

Vietnamese Nuclear Physicians Certified in the United States

In addition to support for the above projects, since 1973, six Vietnamese physicians obtained certifications to practice nuclear medicine from the **American Board of Nuclear Medicine**.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: *World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS*)

Availability of clean drinking water for the population in Vietnam is a matter of great concern, particularly in the country's two major cities, **Hanoi** and **Ho Chi Minh City**. In 2001 the IAEA began an isotope hydrology-related TC project that is working with the **Vietnamese Center of Nuclear Techniques (CNT)** to assess the levels and identify the sources of groundwater contamination. Nuclear techniques are being used to identify the main sources of groundwater contamination, thus facilitating improved water resource management and assuring the population has continued access to clean drinking water.

HUMAN RESOURCE DEVELOPMENT

Exchanges and training missions between the U.S. and Vietnamese counterparts work to build the capacity of local leaders by providing hands-on experience in handling more sophisticated science and technological tools.

- *Since 1994, approximately 29 Vietnamese participated in 18 training courses hosted by the U.S.*
- *Since 1969, the U.S. accepted 19 Fellows and 13 Scientific Visitors from Vietnam, 11 of which were fully funded by the U.S.*

TRAINING IN THE U.S.

Vietnamese Fellows, Scientific Visitors, and Course Participants have trained with U.S. counterparts in a variety of U.S. institutions in the following technical areas:

- **Nuclear Safety** – Argonne National Laboratory
- **Food Preservation** – Louisiana State University
- **Nuclear Medicine** – American Red Cross
- **Plant Breeding** – U. S. Department of Agriculture
- **Energy Development** – U.S. Nuclear Regulatory Commission (NRC)



(Source: *Argonne National Laboratory*)

THROUGH BILATERAL EFFORTS

In addition to U.S. support provided through the IAEA, the following cooperative arrangements between the U.S. and Vietnam have occurred on a direct, bilateral basis:

EDUCATIONAL EXCHANGES

Since 1958, four Vietnamese students received Ph.D.'s from U.S. universities in the area of nuclear studies and an additional four Vietnamese received Ph.D.'s in the field of physics.

OFFICIAL VISITS

For the past 15 years, over 60 Vietnamese have either visited or been assigned to U.S. Government facilities, and numerous U.S. officials have visited Vietnam.

COMPUTER CODE EXCHANGE AND ASSISTANCE

Numerous exchanges of computer codes and related assistance have occurred between the U.S. and Vietnam since 1996. Such exchanges have provided assistance in a variety of technical areas, such as radiation transport and safety.

THE UNITED STATES AND YEMEN

THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY



The Technical Cooperation Department of the International Atomic Energy Agency (IAEA) transfers nuclear and related technologies for peaceful uses to countries throughout the world. As the largest donor to the IAEA, U.S. support for the Technical Cooperation (TC) program has enabled over 100 developing member states to utilize nuclear technology to overcome the challenges of water scarcity, food insecurity, malnutrition, malaria, environmental degradation and many other problems. In recent years, this support has focused on promoting tangible and lasting benefits to member states in fields that are vital to human development, including agriculture, human health, water resource improvement and management, and human resource development. The U.S. takes very seriously its commitment to the exchange of nuclear equipment, materials, and information for peaceful purposes and looks forward to continued cooperation with Yemen in support of these efforts, both bilaterally and through the IAEA.

AGRICULTURE

Providing sufficient food for the world's population is a global priority. Nuclear techniques have come to play an increasingly valuable role in supplementing conventional methods of improving agriculture production.



In 2001, the IAEA began a Technical Cooperation project in Yemen that is using nuclear techniques to increase the country's crop production. Agriculture is an important economic sector in Yemen, accounting for more than 75 percent of the country's workforce. However, cultivation practices have resulted plant types with high water consumption needs. The IAEA is working with the Yemeni **Agricultural Research and Extension Authority** to use plant breeding and genetic techniques to develop crop varieties that have lower water requirements. The introduction of the new crop varieties will help to improve the income of Yemeni farmers while also preserving the country's precious water resources.

IAEA Technical Cooperation Projects

- *There are currently 27 active national and regional TC projects ongoing in Yemen.*
- *These projects are working with Yemeni counterparts in critical development areas such as agriculture, human health, livestock production, water resource management, and human resource development and training.*

HUMAN HEALTH

Peaceful applications of nuclear technology are used to make major contributions to establishing and maintaining good health. Radioisotopes and nuclear detection equipment have become indispensable tools in the diagnosis and treatment of human diseases, such as cancer and malaria.



The IAEA is currently working with the **Yemeni Ministry of Health** to expand the country's radioimmunoassay (RIA) cancer detection capabilities.

This project is establishing the first radiotherapy center at **Al-Gamhouri Hospital in Sana'a**. The center will provide oncological treatment to all sectors of the population and will particularly benefit those who cannot afford to travel abroad to seek medical treatment.

ISOTOPE HYDROLOGY

Through IAEA Technical Cooperation projects, developing countries are learning to use isotope techniques to investigate and manage their increasingly scarce water resources. Isotope hydrology aids national and regional water resource management programs by providing information on sources, movement, and quantity of water in a variety of environments.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

One of such projects, currently underway, is using nuclear techniques to manage and protect the supply of fresh drinking water throughout the region. The IAEA is working with the *National Water Resources Authority (Nwra)* to incorporate isotope hydrology methods into the ongoing study of the severe water shortage problems in Sana'a. Upon successful completion of this project, the country will be able to obtain reliable estimates of available water resources in the region. It will also enable local authorities to develop a sustainable water management plan that will provide the region with water for human consumption and agricultural use.

In addition to the above project, there is also a **Regional West Asia** Technical Cooperation project ongoing in Yemen that is using isotope applications to improve the region's groundwater use. This project was first initiated in 1999 with a focus on developing strategies that will allow neighboring countries to optimize their water resources. It is also studying water leakages and structural stability of existing surface reservoirs to protect available fresh water supplies.



(Source: World Summit on Sustainable Development Brochure/U.S.AID, DOE & DOS)

TRAINING PARTICIPATION

Yemeni counterparts have also participated along with the U.S. at the following IAEA sponsored training courses:

- In April 1996, Yemen was represented at a training course on *Implementation of Radiation Protection at the National Level* held at the U.S. Department of Energy's Argonne National Laboratory in the U.S.
- In March 2003, a Yemeni delegation participated in an *International Conference on Security of Radioactive Sources* held in Vienna, Austria.
- In September 2003, Yemen was represented at an *International Conference on National Infrastructure for Radiation Safety* held in Rabat, Morocco.

PARTNERSHIP WITH THE U.S.

Along with the U.S. and Europe, Yemen cosponsored the following resolutions at the IAEA's meetings of the General Conference:

- *September 2003* - Nuclear and Radiological Security, Progress on Measures to Protect Against Nuclear and Radiological Terrorism.
- *September 2002* - Nuclear Security, Progress on Measures to Protect Against Nuclear Terrorism, Measures to Improve Nuclear Security and Protection Against Nuclear Terrorism.

In addition to the above collaboration, in July 2003, the Chairman of the **Yemeni National Atomic Energy Commission** traveled to the U.S. to discuss an agreement for bilateral cooperation in the areas of peaceful uses of nuclear energy, radiation protection, and science and technology.